

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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COMMScope TECHNOLOGIES LLC,  
Petitioner,

v.

DALI WIRELESS, INC.,  
Patent Owner.

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Case IPR2023-00466  
Patent 9,197,358

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**DECLARATION OF DANIEL FOTY, PH.D. IN SUPPORT OF THE  
PATENT OWNER'S PRELIMINARY RESPONSE  
UNDER 35 U.S.C. §§ 311-19 AND 37 C.F.R. § 41.100, ET SEQ.**

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## I. INTRODUCTION

1. I submit this Declaration on behalf of Patent Owner Dali Wireless Co. Ltd. (“Dali Wireless” or “Dali”) concerning U.S. Patent Nos. 9,197,358 (Exhibit A, “the ’358 patent”). This Declaration summarizes my opinions with regard to Commscope’s Petition, IPR2023-00466, Paper 2 – in particular, regarding the Petition’s assertions that Claims 7, 8, 9, 10, 11, 15, 17, 18, 20, and 21 of the ’358 patent should be declared unpatentable by the PTAB. This Declaration will also include a brief discussion of the background of the technology of the ’358 patent, and conclusions regarding the patentability (or lack thereof) of Claims 7, 8, 9, 10, 11, 15, 17, 18, 20, and 21 of the ’358 patent.

2. In the preparation of this Declaration, I have confined my analysis to the materials and opinions that were available at the time of the preparation of this Declaration – supplemented with my own knowledge and experience in the field. Should new materials, analyses, or opinions be introduced subsequent to the filing of this report, I reserve the right to provide supplementary declarations to the extent necessary to address any such newly-introduced items.

3. As a brief overview, in my preparation of this Declaration, I reached the conclusion and opinion that Claims 7, 8, 9, 10, 11, 15, 17, 18, 20, and 21 of the ’358 patent are patentable – and thus, that the PTAB should confirm that these claims of the ’358 patent are patentable. Further, it is my conclusion and opinion that the

Petitioner has not shown that it has a reasonable likelihood of demonstrating that the challenged claims of the '358 patent are unpatentable – and thus that IPR proceedings against the '358 patent should not be instituted.

4. I am being compensated for my work in this matter at an hourly rate of \$550 for consulting services. My compensation in no way depends on the outcome of this litigation.

## **II. QUALIFICATIONS AND EXPERTISE**

5. My qualifications to testify as an expert in wireless communications and networks, including radio frequency (RF)/radio technology, are set forth in my *curriculum vitae* attached as Exhibit 2003, including a listing of cases in which I have provided expert testimony. I have more than thirty years of experience as an engineer, scientist, and consultant in the electronics industry, including in the areas of integrated circuit (IC) design, layout, structure, and operation, in RF technology for wireless communications, in technology development, and in technical and business development.

6. Much of this work has involved efforts to develop viable-and-efficient millimeter wave radio technology (operating at frequencies in the range of 57-95 GHz) for high data rate wireless communications at the level of many antennae and small coverage areas—as well as for high data rate wireless backhaul technology for deployment in developing regions, such as sub-Saharan Africa. I have authored or

co-authored four books and some sixty papers (published in refereed journals and refereed conference proceedings), mostly on various aspects of integrated circuit technology and RF/wireless technology. I have also given some eighty lectures and presentations (many of them invited) at various conferences and other similar fora, and I have given invited keynote speaker talks on next generation wireless technologies at a variety of conferences and events throughout the world. I have also served extensively as an expert witness in a wide variety of matters over the past 15+ years.

### **III. SCOPE AND PREPARATION OF THE DECLARATION**

7. In preparing this Declaration and in formulating my opinions and conclusions, I have considered - along with my expertise, knowledge, and experience with electronics technology and wireless communications technology - the information referenced or mentioned in the body of this Declaration, in the Petition filed by Commscope (“the Petitioner”), in the Declaration provided by Commscope’s expert Dr. Anthony Acampora, Exhibits 1001-1009, 1016, 1017, 1022, 1025, 1026, and the documents cited within my Declaration. There are also images and explanations in this Declaration which are included for illustrative purposes – particularly for purposes of explaining the nature of the technology-at-issue to the Board. In those instances, footnotes are provided in this Declaration containing the links to the sources of these illustrative images and explanations.

8. I am not an attorney and will not provide any opinions of law. My opinions are from the perspective of a person of ordinary skill in the art (POSA) – and of how such a POSA (at the time of the invention) would review the asserted materials, apply the Board’s claim construction, and understand the claims and written descriptions of the ’358 patent; all of this was done with respect to the legal requirements that are used if invalidity is to be demonstrated. In terms of relevant issues of law, I have asked the attorneys at Folio Law for assistance so that I may apply those issues of law, as appropriate, to my analysis; my understandings of matters of law (as drawn from those requests for assistance) are provided below, in Sections V – VII.

#### **IV. SUMMARY OF OPINIONS**

9. It is my conclusion and opinion that Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 of the ’358 patent are patentable. It is my further opinion and conclusion that the Petitioner has not demonstrated (via its Grounds 1 – 7) otherwise - and that the Petitioner has failed to show that it has a reasonable chance of success in demonstrating unpatentability of any of these claims via those seven grounds. Details of the analysis that led to that conclusion and that opinion are presented later in this report, in Section XI.

## **V. PERSON OF ORDINARY SKILL IN THE ART**

10. I understand that patent claims are viewed from the perspective of a Person of Skill in the Art (POSA) at the time of the invention, where the “art” is the field of technology to which the patent is related. The purpose of using the viewpoint of a person of ordinary skill in the art is for objectivity and thus provides a viewpoint that is not the perspective of the inventor, a layperson, or a person of extraordinary skill in the art, at the time of the invention.

11. It is my understanding that the relevant factors to consider in determining the level of ordinary skill in the art include at least the following: (1) the type of problems encountered in the art; (2) the prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the educational level of workers in the field. In analyzing the proper level of skill in the art of the ’358 patent, I have considered each of these factors.

12. The ’358 patent is related generally to wireless communications – and more specifically, wireless communications technology that involves what are known as Distributed Antenna Systems (DAS).

13. I understand that the Patent Trial and Appeal Board (PTAB) has determined the ordinary level of skill in the art for the ’358 patent in its Institution Decision in IPR2021-00492. *See* Ex. 1025 at 9-10. In IPR2021-00492, the PTAB

found that the ordinary level of skill in the art is as follows: A POSA is someone with (1) a bachelor's degree in electrical engineering; and (2) a minimum of 3–4 years of industry experience in wireless communications networks and engineering but that an individual with an advanced degree in electrical engineering would require less industry experience (e.g., 1–2 years), and have some knowledge or experience with DAS. *Id.* I used this definition for the preparation of this Declaration, and for my analysis.

14. Further, at the time of the respective priority dates of the '358 patent, I qualified as a person of at least ordinary skill in the art. Further, although my level of skill is now considerably beyond that, I can and did objectively address the Asserted Claims from the perspective of a person of ordinary skill in the art as of the priority dates – and did so in the preparation of this report.

## **VI. CLAIM CONSTRUCTION**

15. In order to better understand the challenged claims, I have reviewed the '358 patent, the prosecution history, and previous decisions regarding construction of the '358 patent with respect to a term that appears to be destined to be disputed between the parties – and have drawn my own conclusions regarding the meaning of that term. My conclusion agrees well with Dali's proposed construction for this term – and thus, in conducting my analysis of the Asserted Claims, to which I have

applied what I am informed is the legal understanding, I have used the construction for “a [first|second] communication unit” that has been proposed by Dali.

## **VII. BURDEN OF PROOF TO SHOW UNPATENTABILITY**

16. I understand that a U.S. Patent is presumed to be valid. I also understand that the burden of proof required for instituting an Inter Partes Review is that the Petitioner must show that at least one claim is likely to be unpatentable by a preponderance of the evidence.

17. I understand that the Petitioner has this burden of proof to show that it is “likely” that the allegation is, in fact, true—i.e., that the challenged Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 of the ’358 patent and Claims 1, 2, 3, and 11 of the ’261 patent are unpatentable. As I will explain in this report, Dr. Acampora’s analysis and arguments do not meet this burden of proof – and thus, the asserted claims of the ’358 Patent are patentable .

### **A. Requirements to Prove Anticipation**

18. I understand that a showing of anticipation involves a comparison of the construed claims to the alleged prior art and, to anticipate a patent claim, a single prior art reference must disclose each element of the claimed invention, either expressly or inherently. The prior art reference must also have disclosed each element prior to disclosure of the claimed invention.

**B. Prior Art Reference Must be Enabling**

19. For anticipation, I understand that a prior art reference must be enabling. That is, it must teach a POSA how to make or carry out the claimed invention without undue experimentation and must place the claimed subject matter in the possession of the public.

20. I further understand that whether or not the requisite amount of experimentation is “undue” may include consideration of: (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

**C. Prior Art Reference Must be Publicly Accessible**

21. I understand that for a prior art reference to be considered as a printed publication it must be accessible to the public before the time of the claimed invention—and, if it is not, it is not considered to be prior art. I understand that a reference is considered publicly-accessible if it was disseminated or otherwise made available to the extent that persons interested and ordinarily- skilled in the subject matter or art exercising reasonable diligence, can locate it. I understand that the challenger of a patent bears the burden to show that a reference is publicly accessible.

**D. Prior Art Reference Must Identify Material with Detailed Particularity to be Incorporated by Reference**

22. I understand that material can be incorporated by reference by citing the material in a manner that makes clear that the material is effectively part of the host document as if it were explicitly contained therein. Specifically, I understand that the host document must identify with detailed particularity **what** specific material it incorporates and must clearly indicate **where** that material is found in the various documents. Furthermore, I understand that a POSA should be able to determine whether the host document describes the material to be incorporated by reference with sufficient particularity.

**E. Requirements to Prove Obviousness**

23. I understand that a patent is not obvious unless the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time that invention was made to a POSA. I understand that the question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations. I understand these factual determinations are referred to as the *Graham* factors, and must be considered in a determination of obviousness.

24. I further understand that a showing of obviousness must demonstrate that a person of ordinary skill in the art at the time of the invention would have combined prior art elements to yield the claimed invention. When multiple prior art references are combined, I understand that a claimed invention is not obvious unless a POSA would have been motivated to combine the references. I also understand that there must be some articulated reasoning with some rational underpinning to the prior art references in order to support the conclusion of obviousness. I further understand that it is improper to use the challenged patent itself as a guide to the combination of prior art references; any attempt to assert invalidity must avoid using “impermissible hindsight.”

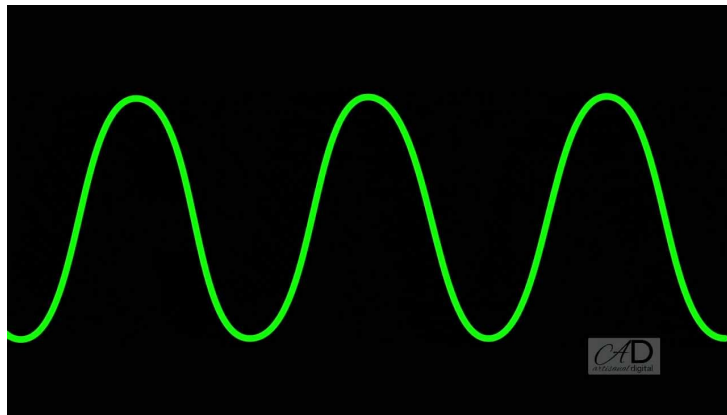
## **VIII. BACKGROUND OF THE TECHNOLOGY**

25. Before discussing the '358 patent in detail, I believe that an appropriate background overview of the pertinent technology related to wireless communications and wireless communications networks—and how they function—is necessary. This discussion builds an appropriate foundation that for my analysis in this Declaration. First, I will discuss basics of wireless communications, and then examine the nature of the heterogeneous (i.e., a combination of wireless and wired) networks that, among other things, are necessary for wireless communications to function.

## A. Basic Aspects of Radio Communications

26. The starting point (the “tip of the spear”) in wireless communications is the use of radio (i.e., wireless) methods of conveying information from one location to another. There are some aspects of radio signals that need to be understood before one can understand the use of radio signals to convey information—particularly, as will be explained later, as the basic physics is rather different from that of wired methods of conveying information.

27. First, consider a simple perfect sinusoidal signal.



28. Such a signal is described mathematically as

$$X(t) = A \cdot \sin(\omega \cdot t),$$

where  $X$  is the function at a particular point in time  $t$ ,  $A$  is the amplitude of the signal (as  $\sin(x)$  varies only between -1 and 1, this factor must be included to describe a real signal), and  $\omega$  is the radial frequency of the signal. By inspection, this signal is continually repetitive—and it will repeat itself over a span of time known as the *period*, which can be written as  $t_p$ . The period is in units of time—and thus the sine

wave repeats itself every  $t_p$  seconds. For clarity, it is common practice to treat the sinusoidal signal not in terms of how long one period is, but rather in terms of how many repetitions occur in one second. This is the inverse of the period, and is known as the *frequency* ( $f$ );

$$f = \frac{1}{t_p}.$$

29. The frequency  $f$  is defined as the number of sinusoidal repetitions that occur per second—which was long referred to in radio engineering as “cycles per second.” This unit of “cycles per second” is referred to as “Hertz” (abbreviated in usage as “Hz”)—in honor of the early (late 19<sup>th</sup> century) German radio pioneer Heinrich Hertz. Further, because (when using a scale of radians), one cycle of a sine wave takes a “time” (mathematically) of  $2\pi$ , the relationship between the actual frequency  $f$  and the mathematical expression necessary for use in the equation above (which requires the use of the radial frequency  $\omega$ ) is:

$$\omega = 2\pi f.$$

From here, only the frequency  $f$  will be referred to—in terms of signal repetition in some given number of Hz. As noted above, an oscillating, sinusoidal signal is defined by its respective magnitude ( $A$ ) and its frequency ( $f$ ).

30. However, note that this simple sinusoidal signal has a single frequency – and continues infinitely in time; a simple, infinite-in-time sinusoidal signal of this

type is unable to convey information; if such a sinusoidal signal is to convey actual information, it *cannot be infinitely-unchanging with time*. In other words, to convey information, the basic sinusoidal signal will have to change in time.

31. However, if the signal is no longer infinitely-long in time, then *it can not be comprised of a single frequency*—as in the depiction shown earlier for the ideal case of a perfect sinusoid which continues infinitely in time. The implication of this statement is that *in order to convey information, more than one frequency must be used*. That is, to convey information, at least some range of frequencies around the central carrier frequency must be used. It is the span of this range of frequencies that defines the *bandwidth* of a channel. Further, it is the bandwidth of a channel that determines how much data (i.e., the rate at which the channel can carry data) that channel can carry; this is why the terms “data rate” and “bandwidth” have essentially become synonymous in wireless communications (and other forms of communications, such as fiber-optic communications).

32. Finally, one of the prime reasons that “bandwidth” and “data rate” are noteworthy is because, in wireless communications, they are scarce commodities. The demand for wireless bandwidth is large and continues to grow at astonishing rates. Because of these great demands being made on a scarce resource, methods and technologies for making more-effective use of these scarce resources are highly desirable and in great demand. The ’358 patent discloses methods and technologies

that enable systems using their teachings to make more-effective and more-efficient use of this scarce resource.

**B. Modulation of Radio Signals to Convey Information**

33. As discussed above, for a radio signal (or any other sinusoidal signal) to convey information, the “purity” of that sinusoidal signal (i.e., the case where the sinusoidal signal has a single frequency that is not altered in time) to some degree is discarded—and frequencies are added-in to that originally-pure sinusoid. Over the years, many methods have been developed for imposing information onto a radio signal when it is generated. That modified radio signal, based on a pure-sinusoid “carrier,” is then transmitted over the air and received at some other location. The information imposed onto that carrier is recovered at the receiving location.

34. The various methods of imposing information onto what was originally a pure sinusoid is known as *modulation*. This term is reflected in the commonly-known AM (“amplitude modulation”) band or FM (“frequency modulation”) band. These are particular frequency bands, popularly referred to as “AM radio” and “FM radio,” are-and-were allocated by regulatory authorities.

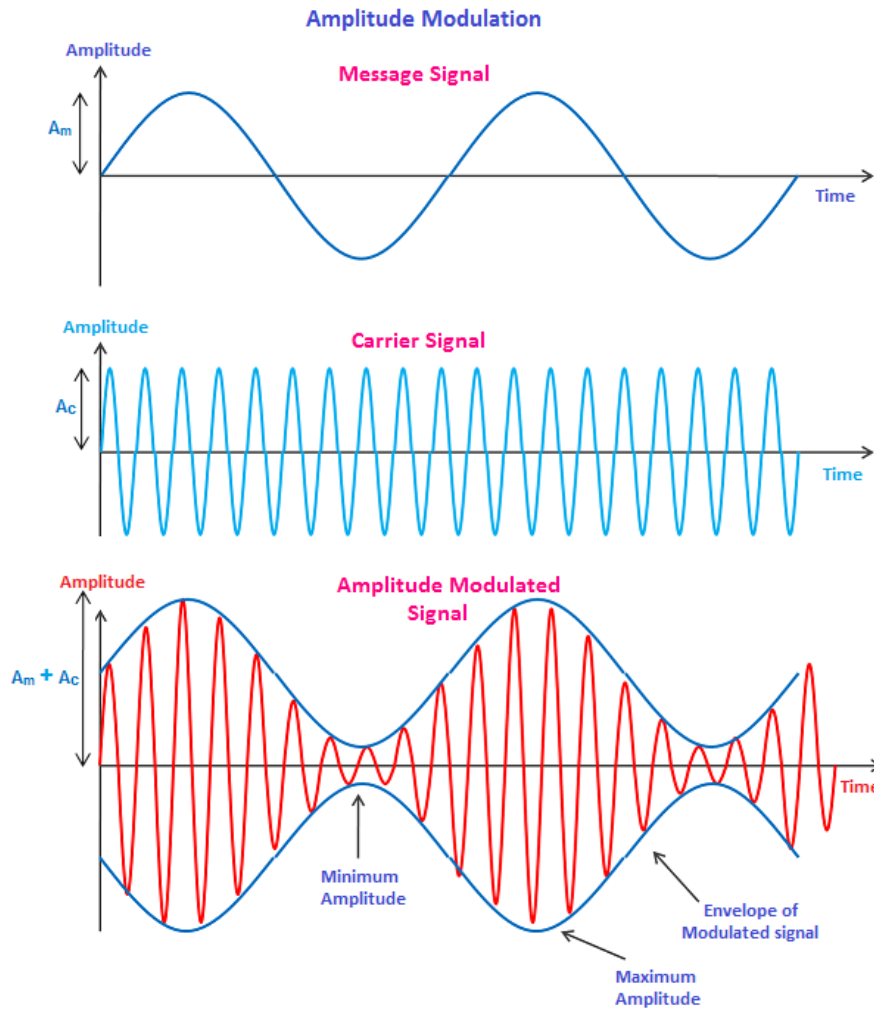
35. When a modulated signal is received, it must be processed so that the modulated- information can be recovered. This process is known as *demodulation*. As merntioned above, there are very-many methods that are used for modulating information into/onto a radio sinusoid carrier. Most of these methods are very

complicated and heavily-mathematical; however, the method of amplitude modulation is simple to understand, and provides an example that furnishes a basic level of understanding.

36. Amplitude modulation means that the *amplitude* of a carrier radio wave is *modulated* by changing the amplitude (but not the frequency) of that carrier. This is done by modulating the amplitude of the overall radio signal (e.g., a 1MHz radio wave) so that the amplitude rises and falls with the lower-frequency information (e.g., a 440Hz electronically-rendered audio signal that is to be conveyed). This is best-explained (and most-readily explained) with a simple diagram.<sup>1</sup>

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<sup>1</sup>Source: [www.physics-and-radioelectronics.com/blog/wp-content/uploads/2018/05/amplitudemodulation.png](http://www.physics-and-radioelectronics.com/blog/wp-content/uploads/2018/05/amplitudemodulation.png).



37. As can be seen from the above, at the sending end, the amplitude of the message signal (at, e.g., 440Hz) is used to modulate the amplitude of the carrier signal (at, e.g., 1MHz). At the receiving end, the radio signal (the 1 MHz radio signal) is discarded, and the underlying conveyed information (the 440Hz electronically-rendered audio signal) is recovered – in the form that this signal existed before it was modulated onto the 1 MHz carrier signal, so that it could be conveyed across some distance.

38. A reasonable analogy is that the 1MHz radio signal is the package (i.e., a shipping box), while the 440Hz signal is the “contents” of that package – which the shipping box is used to ship.

39. To continue the analogy, when the “package” is received, the shipping box has served its function and is discarded – as the contents of the “package” has reached its destination and been extracted.

40. As noted above, amplitude modulation is a very simple method of modulating information onto a radio carrier sinusoid. While there are multiple other methods that are in use, all provide a method in which more than one frequency is used (as per the discussion and diagrams above) to allow a simple radio-frequency sinusoid to convey information from one location to another.

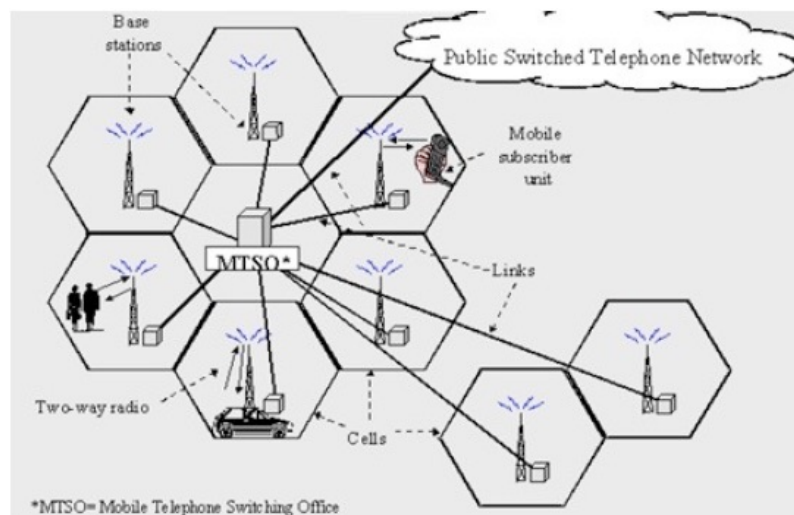
### **C. Heterogeneous Networks**

41. The discussion above also, by implication, makes clear another fact-of-life with respect to “wireless” communications—a great deal of equipment (and active-processing therein of various types) is required to support the parts of the communication that are, in fact, actually “wireless” (i.e., over-the-air, using radio waves).

42. The combination of wireless communications with the wired communications systems that support the entire network is often called a *heterogeneous network*. A heterogeneous network contains both wireless and wired

components, and the wireless parts where the end users operate, while the wired parts are the critical infrastructure that supports the wireless parts. Of course, the wired parts that support the wireless parts are also integrated into larger wired networks—so that the wired parts also serve wired communications as they deal with other networks. But for further consideration here, the wired parts of the heterogeneous networks are necessary for the wireless parts of the network to function.

43. An exemplary heterogeneous network is depicted in this figure.<sup>2</sup>



Although simple, this diagram details a contemporary heterogeneous network. A large background wired network (usually employing optical fiber technology) moves information around—to-and-from the information sources, and also out to the edges of the wired network where there are connections via wireless links.

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<sup>2</sup>Source: <https://www.itu.int/osg/spuold/ni/images/mtso.gif>.

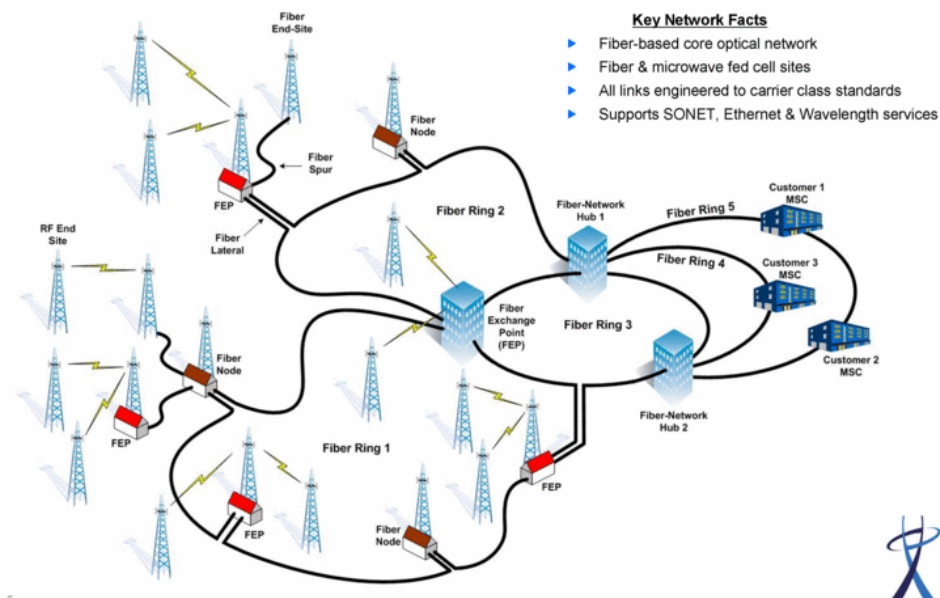
44. In common parlance, the coverage area associated with a particular transmission facility is often referred to as a “cell” (i.e., one of the hexagons in the diagram above)—with the general idea being that each transmission facility is only able to provide reasonable signal coverage over a small area, and thus multiple repeated instances of cells (as depicted in the diagram) are required to provide signal coverage over a larger total area. This diagram depicts a minimalist depiction of such a network—with a central facility (here, the MTSO) that connects to facilities in each cell; in each cell, the minimalist equipment set includes a base station and a cell tower – where each cell tower contains at least one radio head. More-detailed descriptions of a heterogeneous network will be provided momentarily below, when the more-detailed architecture of such a network is considered.

45. In general, the wired connections in the network that include those that go out to a base station (or between base stations) constitute what is known as the *backhaul* of the network.<sup>3</sup>

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<sup>3</sup> [http://www.getfilings.com/sec-filings/100609/FiberTower-CORP\\_8-K/g117292mmi005.gif](http://www.getfilings.com/sec-filings/100609/FiberTower-CORP_8-K/g117292mmi005.gif).

## FiberTower Backhaul Network Architecture



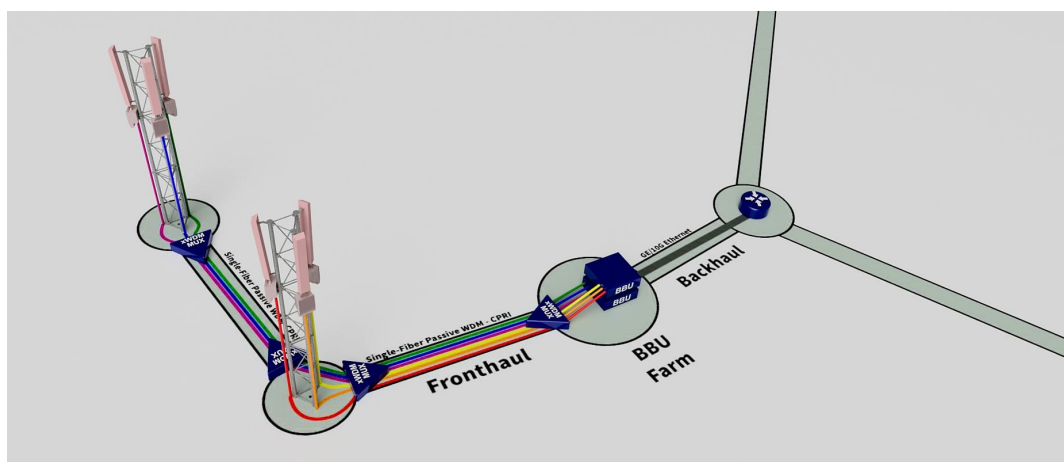
Typically, fiber optic links move data around in the overall backhaul, and deliver information to and from the base stations which serve the wireless parts of the network.<sup>4</sup>

46. In addition, a base station communicates with radio heads that actually transmit and receive the over-the-air radio signals that constitute the wireless parts

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<sup>4</sup>This is the method for the delivery of data to base stations that is most-commonly used in North America. Tower operating companies (such as American Tower, Crown-Castle, and SBC Communications) own and operate large fiber-optic networks for this purpose. In other parts of the world, microwave links are frequently used for the same purpose.

of the network. A base station may be located very close to the radio heads that it serves, or quite far away from them. The connection between a base station and any radio heads which that base station serves is also done in a wired manner—and is also usually accomplished using fiber-optic connections. This part of the network—between the base stations and their associated radio heads—is known as the *fronthaul*.<sup>5</sup>



Architecturally, the fronthaul can include the direct fiber optic connection between a base station and a facility with radio heads (such as a “cell tower”), and also a further fiber optic connection from such a first facility to another such facility (e.g., another “cell tower”) beyond the first facility.

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<sup>5</sup>Source: <https://edgeoptic.com/wp-content/uploads/2017/07/Wireless-Fronthaul.jpg>.

47. Further, the architecture depicted in the diagram above provides an implementation of the radio-access network architecture that is described in a textbook on 4G communications<sup>6</sup> written by Dahlman et al., of Ericsson’s research labs. This diagram embodies what Dahlman describe as: “The LTE radio-access network uses a flat architecture with a single type of node—the *eNodeB*. The eNodeB is responsible for all radio-related functions in one or several cells. It is important to note that an eNodeB is a *logical* node and not a physical implementation. One common implementation of an eNodeB is a three-sector site, where a base station is handling transmissions in three cells, although other implementations can be found as well, such as one baseband processing unit to which a number of remote radio heads are connected. One example of the latter is a large number of indoor cells, or several cells along a highway, belonging to the same eNodeB. Thus, a base station is a *possible* implementation of, but not *the same* as, an eNodeB.”<sup>7</sup> (Emphases in the original).

48. This diagram also provides some clarification as to the difference between the backhaul and the fronthaul. As the backhaul is further back in the “core”

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<sup>6</sup>E. Dahlman et al., “4G LTE/LTE-Advanced for Mobile Broadband,” Chapter 8, pp. 109-26 (2011).

<sup>7</sup>Excerpted from E. Dahlman et al., p.111.

of the network, there are vast amounts of data that are transmitted at high data rates. As the diagram shows, this is accomplished using multi-gigabit-per-second Ethernet protocols (and other similar networking protocols). In contrast, the fronthaul—being more localized at the edge of the network, with numerous instances of base stations and radio heads—need not have that level of data-carrying capability. Further, as the diagram shows, in this example, the CPRI standard provides a (fiber-optic) communications protocol for the fronthaul.

49. This now leads naturally to the question of how the wireless parts of the network fit into the picture.

50. First, it should be noted that the wireless parts of the network use sinusoidal radio signals—sent over the air—as their method of conveying information. Information that is traversing through the wired parts of the network (the fronthaul, the backhaul, etc.) is (in general – with one exception, to be discussed below) *not* using radio signals, but is using the standard methods of communicating information – such as the binary 1s and 0s associated with digital data. Information in this wired form is known as being at *baseband*—which is, effectively, a way of saying that it is *not* extant there as information modulated onto radio waves. In particular, radio waves are *generally* not used in the wired sections of a network. The one exception to this division (in a heterogenous network) between wireless radio signals and wired baseband signals occurs when “raw” radio frequency signals

(in the exact form via which they are transmitted over-the-air) are sent over cabling that is specially designed for this purpose; the most common type of cabling of this sort today is coaxial cable. In general, the conveyance of radio frequency signals over such cabling is only used when the distance to be spanned (by the cable connection between source and destination) is relatively short – as such cabling tends to be susceptible to signal degradation by attenuation.

51. Second, with regard to terminology, the receiving side of the connection (i.e., a radio signal is received by a suitable wireless device) is often called the *uplink* side of a wirelessly-conveyed signal.

52. In the uplink, what is known as “down-conversion” is carried out on the received radio signal – to remove the radio “packaging” and recover the signal “content” that was originally transmitted. This signal content, having been stepped down to baseband, requires further processing for the extraction of the actual information contained; fortunately, as the radio “packaging” has been removed, digital signal processing techniques can be brought to bear for that purpose.

53. Continuing with terminology, the transmitting side of the connection (i.e., a radio signal is transmitted by a suitable wireless device) is often called the *downlink* side of a wirelessly-conveyed signal. In the downlink, what is known as “up-conversion” is carried out on the information that is to be transmitted by the radio signal – that is, the information is modulated onto the radio “packaging” that

will be transmitted (as a radio signal). Here, the signal content is stepped up from baseband – so that the radio signal is modulated and thus carries this information.

#### **D. Differences Between Wireless Communications and Wired Communications**

54. When wireless communications networks are used for the transmission of data, several challenges immediately appear. One of the most-fundamental is the disparity between the data-transmission capabilities of the wired parts of the network (effectively, the backhaul and the fronthaul) and the wireless parts of the network.

55. As was noted earlier regarding heterogeneous networks, the wired parts of the network (again, this in general refers to the backhaul and the fronthaul) most-commonly employ fiber-optic cable and optical-communications methods for the transfer of data.<sup>8</sup> The backhaul in particular—being required to convey enormous amounts of data at very high speeds over long distances—is notable for its ability to perform this function. As a diagram above showed, the backhaul employs high-

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<sup>8</sup>This is the method for the delivery of data to base stations (via backhaul) and to radio heads (via fronthaul) that is most-commonly used in North America. With particular regard to backhaul, it is noteworthy that the tower operating companies (such as American Tower, Crown-Castle, and SBC Communications) own and operate large fiber-optic networks for this purpose. In other parts of the world, microwave links are often included in the backhaul.

data-rate methods – such as optical fiber, microwave links, and/or multi-gigabit Ethernet. Further, although fronthaul does not require the very high data-throughput capabilities that are required by the backhaul (at least not to the same degree), fronthaul is also usually implemented using fiber-optic cable and optical communications methods and standards (such as CPRI).

56. However, a multi-faceted problem arises when information is to be transferred via wireless transmission or reception.

57. The first aspect of the problem is that wired communications methods based on optical fiber are very fast and very far-reaching. A single fiber-optic connection is able to transfer data at rates of multiple-tens of gigabits per second, and such connections (particularly if optical repeaters are included) are able to transfer data over thousands of miles—between-and-among the continents themselves. Today’s truly globe-girdling communications networks are based on optical fiber connections that run all-over and all-around the world.

58. In contrast, wireless communication based on radio signals is considerably more limited. Radio transmissions attenuate as they spread out in the air, and thus are limited on that ground alone as to how far they can travel and still

be detectably received. Further, radio transmissions<sup>9</sup> are generally limited in range to line-of-sight. And in addition, any objects or obstacles can block radio signals—or can induce frighteningly-complex inference patterns that can (among other things) cause signal nulls at particular locations within what is otherwise supposed to be a viable coverage region. It has been known for some time that higher radio frequencies offer higher natural bandwidth—and thus are capable of transferring data at rates that are unattainable with lower frequencies; however, these higher frequencies are also more susceptible to both atmospheric attenuation *and* the

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<sup>9</sup>There are some exceptions to this general statement, such as particular radio frequencies that are able to bounce off the ionosphere and thus travel further than line-of-sight; however, these frequencies (such as the old AM band) are scarcely used for contemporary wireless communications. In addition, physical materials (such as building materials used in buildings) vary greatly in their transparency or opacity (or something in between) to radio signals – with the degree of transparency or opacity being a very strong function of the frequency of the radio signals. Further – and again depending on frequency – it is possible for signals to reflect off various material structures and/or terrain features, and be detectable via this sort of “signal bouncing.”

appearance of complex interference patterns that create the aforementioned signal nulls.

59. That last comment is the entry point for the second aspect of the problem—that the wired parts of the network (based on optical fiber) are able to convey data at rates that are much faster than those that are possible using the wireless parts of the network. Although “bandwidth” is not (from first principles) implicitly-related to carrier frequency, in practice (such as the need for channels that are of finite width in the spectrum and thus of limited number for a particular band) the bandwidth of wireless communications is limited by the carrier frequencies that are in general use; even if higher frequencies (with higher natural bandwidth) could be practically-deployed (which, as noted above, is a serious challenge), wireless data transfer is simply unable to be nearly as fast as is wired data transfer over optical fiber.<sup>10</sup>

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<sup>10</sup>As an example that should be readily understood, this more-generalized situation is similar to the one that occurs with in-home networks that use WiFi to transmit to-and-from user devices via a WiFi router; in general, the WiFi router is connected to a wired network of some sort, and the wired network provides the connection to the outside world. The data rate attainable using the wired line into the house (be it fiber, cable, or even DSL) is typically much larger than is the data rate attainable

60. The third aspect of the problem is that wireless spectrum is a carefully-allocated (by regulation) and scarce resource; while it is relatively easy to add more backhaul capacity (i.e., by adding more fiber), it is difficult (both in terms of regulation and in terms of physics) to add more wireless data capacity-and-speed to the wireless part of the network.

61. Taken together, the basic situational challenge associated with heterogeneous networks is thus clear—the rate at which data can be conveyed over both the backhaul and the fronthaul is much larger than is the data rate that is available via over-the-air transmission.

62. Thus, in the industry, there is a demonstrated need to, as much as possible, mitigate the inherent comparative shortcomings in the wireless part of a heterogeneous network. There is thus a widespread need for systems and methods that make more-efficient use of available wireless resources. This need for more efficiency applies to the use of available bandwidth, available spectrum, and other similarly-constrained resources of wireless communications. These needs were

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with a WiFi connection to-and-from the WiFi router; the WiFi connection is the data-rate-limiting-step in the connection between the original source of the data and the end-user-device (in the uplink; a similar-and-obvious situation applies to the downlink).

addressed by the inventors of the '358 patent, via the disclosure of methods to address interference and signal-to-noise issues, so as to make the most-efficient use of the available bandwidth.

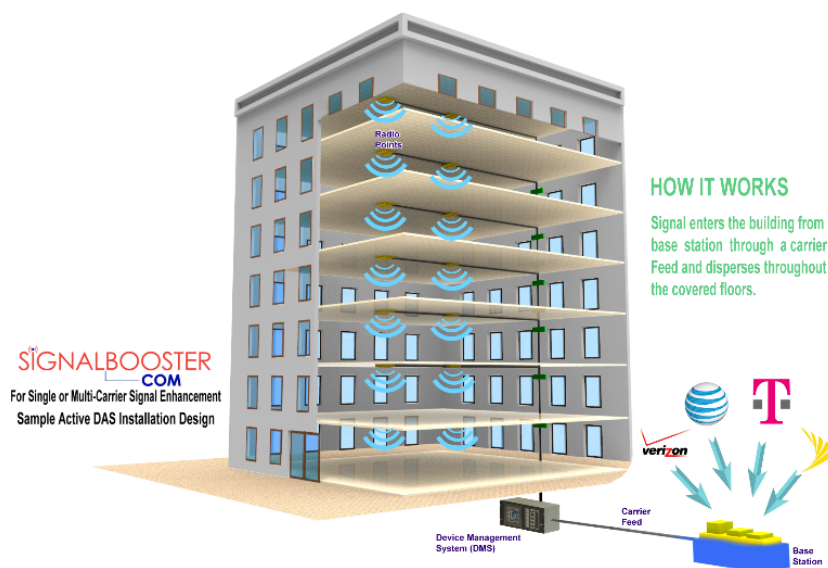
**E. Wireless Communications Adapted for Confined Environments**

63. As noted above, some of the limiting issues associated with radio-based communications include restriction to line-of-sight communication, attenuation of a transmitted signal with distance, and difficulties caused by material objects. Note that this last item includes difficulties caused by enclosed spaces – where it is difficult to get a radio signal to a location from the outside of the structure.

64. An elegant remedy to this problem involves what has become known as the use of a Distributed Antenna System (DAS). A DAS functions in a manner similar to the way that rooms inside a building are *not* illuminated by outside sunlight, or by a large floodlight shining onto the building. In the case of lighting, individual electrical outlets and individual light sources (such as light bulbs) are placed throughout the building as necessary. In the case of a DAS, the same idea applies—antennae are placed throughout the building, so as to provide wireless communications services to users in the various confined areas inside the building.<sup>11</sup>

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<sup>11</sup>[cdn.shopify.com/s/files/1/1142/1404/articles/What\\_is\\_DAS\\_and\\_How\\_Does\\_it\\_Work\\_1024x1024.png](https://cdn.shopify.com/s/files/1/1142/1404/articles/What_is_DAS_and_How_Does_it_Work_1024x1024.png).



As shown in this figure, the basic notions associated with fronthaul are present—e.g., a base station is connected to some sort of (what the figure calls a) Digital Management System (DMS), which then connects to an antenna. However, in this case, rather than a single antenna, the DMS is connected to a large number of antennae throughout the building. Thus, the antenna resources are *distributed* throughout the various confined areas of the building—to maximize the coverage potential of wireless communications.<sup>12</sup>

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<sup>12</sup>An interesting aspect of signal coverage and power management surfaces when a mobile device is dealing with poor signal coverage – and has difficulty maintaining contact with the available wireless communications network. The actions taken by a mobile device to re-establish its basic connection to the network consume a surprising amount of power; thus, if a device is continually losing its connection and

65. By inspection of this figure, it can be seen that this system is a useful-but-rather complex system. This in turn implies that considerable effort is required to render such a system efficient and tractable—as the already-scarce resources (such as wireless bandwidth) are being spread out among a large number of antennae and their associated radio heads. Efficient management of such a system is clearly needed—which is the need that is addressed and enabled by the disclosures of the inventors of the '358 patent.

## **IX. THE '358 PATENT**

### **A. Overview of the '358 Patent**

66. I understand that Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 of the '358 patent are being contested by CommScope in their Petition. I will discuss the details of these asserted claims below, to the extent necessary to respond to that Petition.

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re-establishing it, or if the device is unable to re-establish a connection and keeps trying, the drain on the mobile device battery can be surprisingly severe. Because of this issue, rather than allowing “rampant searching” to try and re-establish a connection, most mobile devices incorporate search algorithms (of various sorts) to manage this searching – so as to keep the battery from being depleted by loss-of-contact with a wireless network.

67. U.S Patent No. 9,197,358 (“the ’358 patent”) was issued on November 24, 2015; the listed inventors are Seyed Hejazi and Shawn Stapleton, and the assignee was (and still is) Dali Systems Co., Ltd. As described in the specification (’358 patent at 1:8-12), the ’358 Patent claims priority to U.S. Provisional Appl. No. 51/649,143 (“’143 Provisional”), which was filed on May 18, 2012.

68. The disclosures of the ’358 patent are addressed to improving the state-of-the-art with respect to a core, long-running problem associated with wireless communications (as explained in Section VIII) – that wireless bandwidth is a scarce commodity, and it must be allocated and used with utmost efficiency. In particular, the ’358 patent combines two techniques that improve that efficiency – with the combination creating a new-and-unique wireless system architecture.

69. The first technique (which was also described in Section VIII) involves what is known as a Distributed Antenna System (DAS). As detailed in Section VIII, a DAS transcends the traditional large-area, large-scale broadcasting methods of a conventional cellular communications system by bringing the transceiver systems that communicate with user equipment (UE) closer to those end users and their wireless-communication-capable devices (be they fixed or mobile, line-powered or battery-powered). As the ’358 patent discloses,

A DAS is advantageous from a signal strength and throughput perspective because its remote antenna units are physically close to wireless subscribers. The benefits of a

DAS include reducing average downlink transmit power and reducing average uplink transmit power, as well as enhancing quality of service and data throughput. ('358 patent at 1:27-32).

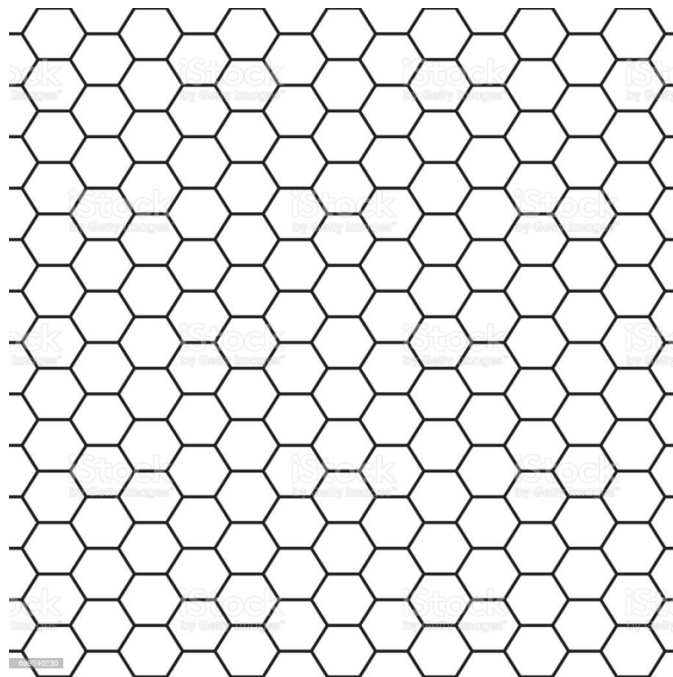
70. Due to the reduced communications distances involved (as compared with the traditional, conventional large-cell approaches), transmit and receive power are reduced (as communication can be achieved at lower power levels).<sup>13</sup> In addition, the shorter communication distance reduces the possible occurrence of incidental effects – such as “dead zones” that are caused by shadowing and/or destructive interference; as the specification of the '358 patent notes, by reducing the communication distance, difficulties (such as those just mentioned) are mitigated – and both the quality-of-service and the data throughput will be enhanced.

71. The second technique involves frequency re-use techniques – in particular, Fractional Frequency Reuse (FFR) and Soft Frequency Reuse (SFR). These techniques represent an improvement over what is known as Hard Frequency Reuse (HFR) – as will be explained below.

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<sup>13</sup>As was explained in Section VIII, for an isotropically-propagating radio signal, the strength of the signal will decrease in proportion to the *square* of the distance from the transmitter.

72. Frequency reuse techniques were developed to address an operational problem in cellular-based wireless communications – a method in which the wireless communications architecture is based upon the division of the covered geography into separate, individual cells, and in which each cell is operated as a basic, independent unit of that architecture. A honeycomb-like division of the geography into hexagonal cells (something which appeared in Section VIII) has been used since the early days of wireless telephony.<sup>14</sup>



This sort of hexagonal structure provides complete converge of the geographic area, while keeping cell boundaries at a relatively-fixed distance from the center of the cell

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<sup>14</sup><https://media.istockphoto.com/vectors/hexagon-pattern-vector-id699240230> .

(something that is much-more-poorly done in a chessboard-like architecture involving rows and columns of squares).

73. However, a problem with the independent-cell approach is that electromagnetic radiation (such as the radio signals used in wireless communications) does not respect the arbitrary boundaries of the constituent cells of a cellular system – since, as mentioned above (and in Section VIII), electromagnetic radiation will propagate freely, with the intensity of the signal decreasing – continually, not abruptly – in proportion to the square of the distance from the transmitter. Thus, if two carriers are transmitted in two adjacent cells, the intensity of the signal in one cell may be strong enough to be detectable by end-user equipment in the other (adjoining) cell – where it is (in an ideal world) not supposed to be present. This unwanted signal from the neighboring cell (or, in reverse, transmitted by end-user equipment in a neighboring cell) can interfere with the desired transmissions and receptions within a particular cell.<sup>15</sup>

74. One technique that is used to mitigate this problem is Hard Frequency Reuse (HFR). In HFR, the interference problem is eliminated by simply forbidding

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<sup>15</sup>This amounts to the unintentional occurrence of what is known as intentional “jamming” of radio signals in electronic warfare and electronic espionage.

neighboring cells from using the same carrier frequencies – period. The '358 patent explains this technique graphically at Figure 1A and Figure 1D.

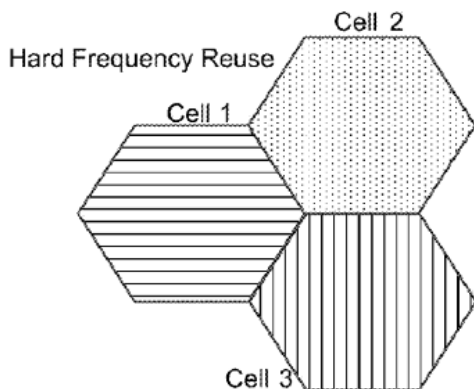


**FIG. 1A**

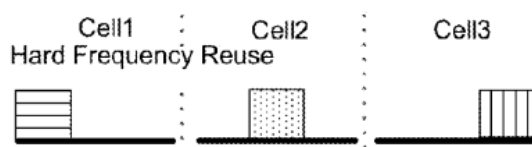


**FIG. 1D**

75. This type of approach will, by brute force, prevent interference outside of a particular cell's boundaries; however, this is indeed a brute-force approach – as each cell is only allowed to use one-third of the available spectrum<sup>16</sup> (as can be

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<sup>16</sup>As the specification of the '358 patent explains, for the full seven-component basic structure of the hexagonal-cell architecture, there is no need to be even more preemptive than what is depicted in Figure 1A – where the available spectrum is divided into three blocks among the three cells as shown. For the full set of a single cell surrounded by six other cells, it can readily be verified that if Cell 1 is designated as the “central cell” in the depiction, the frequency blocks assigned to Cell 2 and Cell

inferred from Figure 1D), so that any propagation of frequencies from one cell into another will simply be rendered irrelevant (via the extra distance to another cell that uses that same sub-allocation of the frequency spectrum). However, as mentioned earlier (and in Section VIII), wireless bandwidth is a scarce commodity; thus, preemptively reducing the carrier capacity of each cell *by two-thirds* is a poor solution to the intercell interference problem; better methods were needed.

76. The '358 patent improves the efficiency of the disclosed DAS network by invoking two techniques that were known in the art – both of which fall under the general heading of frequency reuse. These two techniques were mentioned earlier – Fractional Frequency reuse (FFR) and Soft Frequency Reuse (SFR).

77. Both FFR and SFR share a common base – in which each cell is divided into an inner region and an outer region; this is depicted in the '358 patent in Figure 1B and Figure 1C, which (other than the labeling) are identical.

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3 can alternatively be repeated across the other four adjacent cells (that are *not* shown in Figure 1A); thus, for any particular cell under an HFR scheme, each cell will be assigned one-third of the available spectrum. *See* '358 Patent at 7:10-31.

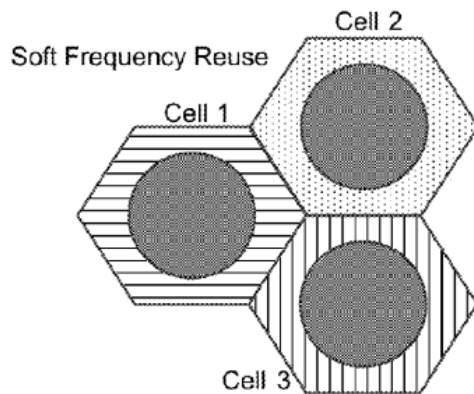
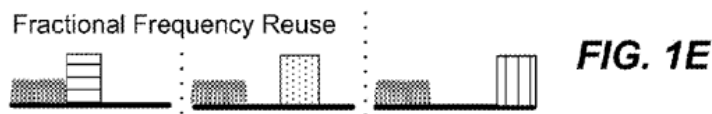


**FIG. 1C**

In both FFR and SFR, there are different spectrum allocation rules in the inner part of the cell as compared with the spectrum allocation rules in the outer part of the cell; FFR and SFR differ in the specifics of those spectrum allocation rules.

78. The spectrum allocation rules used with FFR are explained graphically in Figure 1E.

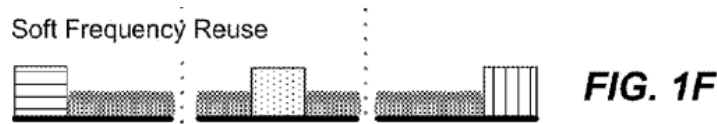


One way to create the disclosed geographic footprints is to use different transmission power strengths for the various footprints. Here, the height of the bar in the figure is used to indicate the power level of transmissions in each of those sub-allocations of the frequency spectrum across the three cells. In the inner regions of the three cells, the power level of transmissions is set low – to reduce the areal extent of the signal coverage; as Figure 1E shows, this allows this sub-allocation of spectrum to be used in the inner regions of all three cells – as they will not interfere with each other.

Meanwhile, using the same technique that was used in HFR, the entirety of each cell (including the outer regions) has a sub-allocation of the frequency spectrum – where, as in HFR, each of the three cells has a different sub-allocation (as shown in Figure 1E, which can readily be compared with Figure 1D). These sub-allocations use higher transmission power – as (unlike the transmissions in the inner regions of the cells) they are intended to provide coverage over the entire cell. As in HFR, as different sub-allocations of the frequency spectrum are provided in adjoining cells, intercell interference at-and-near the cell boundaries is mitigated.

79. The salient aspect of FFR is that it essentially uses the HFR scheme (of different sub-allocations of frequency spectrum in adjoining cells) to mitigate intercell interference, and then adds onto it a general sub-allocation of frequency spectrum to the inner regions of all of the cells. As careful examination and comparison of Figure 1D and Figure 1E indicate, the full-cell-covering higher-power transmissions of FFR use narrower allocations than those of HFR; however, the efficiency of the use of spectrum is, overall, improved from HFR via the ability to use the lower-power inner-region sub-allocation of frequency spectrum in all of the cells – as these transmissions will not have the signal strength to cross cell boundaries.

80. SFR is more complicated – but it provides even-more-efficient use of the available frequency spectrum; this is evident via examination of Figure 1F.



Note in particular that in comparison to the FFR sub-allocations depicted in Figure 1E, in SFR the higher-power suballocations are wider than they are in FFR – indicating that they provide more bandwidth and thus more carrier slots; in fact, by comparing Figure 1F with *both* Figure 1E and Figure 1D, it can be seen that SFR exceeds the situation with these particular sub-allocations as constrained in FFR (to be narrower, as described above) – and, in further fact, SFR allows the bandwidth of these bands that was used in HFR (and intrinsically not available in FFR) to be recovered. SFR is also unique as compared with both HFR and FFR – since (as can be seen in Figure 1F) the *entire frequency spectrum* is made available in all cells. SFR uses the HFR scheme over the entirety of each cell (with the same bandwidth for those sub-allocations that was made available in HFR), and then allocates all of the remaining frequency spectrum (uniquely in each cell) to the inner region of the cell. As noted above, this scheme uses the entire frequency spectrum in each cell – with the only constraint being that these cell-specific sub-allocations are not available in the outer regions of each cell; this is the price that is paid for the benefit of mitigating intercell interference.

81. As the '358 patent summarizes,

HFR, though simple in implementation, suffers from a reduced spectral efficiency.<sup>17</sup> On the other hand, both SFR and FFR have increased (e.g., full) spectral efficiency and are a strong mechanism for inter-cell interference mitigation. ('358 patent, 7:46-49.)

82. As mentioned earlier, the inventive disclosures of the '358 patent involve the combination of frequency reuse techniques and DAS networks – into a unique-and-efficient DAS network architecture that mitigates intercell interference while making efficient use of the available spectrum – which, among other things, serves to increase data transmission rates for end-users and to improve the overall capacity of a DAS network. As the '358 patent notes,

However, an encouraging result is that by using even limited (yet practical) levels of coordination, significant performance benefits can still be obtained over a conventional cellular architecture. Most of the recent publications have focused on investigating SINR [Signal to Interference plus Noise Ratio] advantages of DAS and analyzing its performance. *On the other hand, there are*

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<sup>17</sup> In this excerpt (and in the '358 patent in general), the term “spectral efficiency” means what it facially means – the efficient use of spectrum. However, in the art, there is another, more-complicated definition of “spectral efficiency” – which refers to the number of bits per Hz that can be transmitted by a particular encoding scheme.

*no studies that combine DAS with SFR in order to reduce inter-cell interference.* ('358 patent at 8:52-60; emphasis added.)

This absence is what the '358 patent addresses.

83. The exemplary description of the disclosed DAS architecture is embodied in Figure 2.

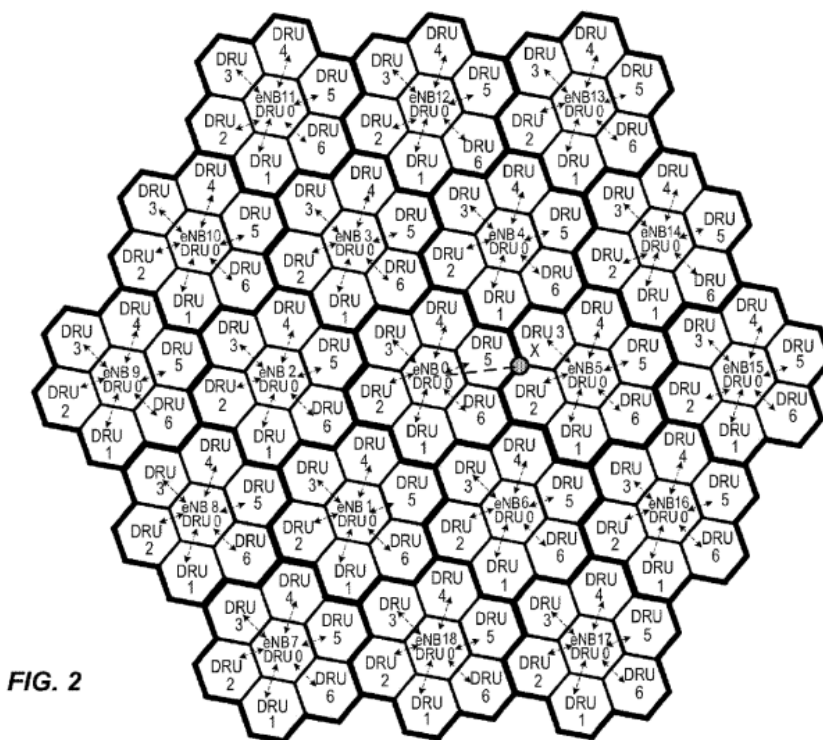


FIG. 2

(For completeness, the dot in the right-center of this figure represents an end-user who is moving within the coverage area depicted in Figure 2.)

84. As detailed in the specification of the '358 patent,

Referring to FIG. 2, the DAS includes a central cell referenced as eNB0, which includes DRU0 through DRU6

that are communicating through one base station at eNB0 through a DAU. DRU0 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. In other embodiments, eNB0 is considered to be Cell 1 in FIGS. 1A-1C and eBN1 [sic], including a different set of DRUs, DRU0 through DRU6, can be considered to be Cell 2 in FIGS. 1A-1C, etc. ('358 patent at 9:42-51.)

The eNB communicates with the DRUs via a DAU; the DAU is not shown in Figure 2.

85. The '358 patent provides a DAS architecture that allows for very flexible allocation of wireless spectrum resources – applying the frequency reuse techniques to further enhance the architectural efficiencies (discussed in Section VIII) inherent in DAS networks.

The general architecture of a Virtualized DAS in a multicell environment is shown in FIG. 2, where 7 Digital Remote Units (DRUs) are connected to an eNB via an optical fiber and a Digital Access Unit (DAU). The DAU are interconnected and connected to multiple sectors. This capability enables the virtualization of the eNB resources at the independent DRUs. The eNBs are linked to a public switched telephone network or a mobile switching center.

DRUs are sectorized such that each DRU allocated to a given eNB sector is simulcast. ('358 patent at 11:52-60).

86. This architecture allows the DAS to more-efficiently allocate resources (i.e., bandwidth) to *where* it is most needed, *when* it is most needed. Further, the '358 patent provides extensive quantitative analysis and algorithms ('358 patent at 12:49 – 18:47) that allow these efficiencies to be implemented and used deterministically in a DAS network.

#### **B. File History of the '358 Patent**

87. The application that eventually led to the '358 patent was filed on May 14, 2013; the application included 21 claims, of which 3 were independent claims. After some minor modifications were made to the specification, the applicant received a notice of publication on August 21, 2014.

88. On December 31, 2014, the applicant received a non-final rejection; this was based on the conclusion by the examiner that all the claims were anticipated by Karabinis (US Patent Application 2005/0239403). In response, on May 27, 2015, the applicant requested a reconsideration of this decision. The applicant argued that the examiner had misinterpreted Karabinis with respect to the claims of the application, and that “Karabinis therefore fails to disclose each and every element of independent claims 1, 7, and 15.” No modifications were made to the claims.

89. These arguments by the applicant were accepted by the USPTO, and on July 17, 2015, the applicant received a Notice of Allowance; the '358 patent was then issued on November 24, 2015.

90. On February 22, 2021, Corning filed an IPR petition with the PTAB, requesting that proceedings be opened against the '358 patent. After patent owner Dali submitted the Patent Owner's Preliminary Response, the PTAB decision was to deny institution – and to leave the challenged claims of the '358 patent as being patentable. (See Ex. 1025.)

## **X. SUMMARY OF THE ASSERTED REFERENCES**

91. In their Petition, the Petitioner lists five references upon which they has relied for their challenge; these five references are:

- 1) X. Xu et al., “Imperfect Digital-Fiber-Optic-Link-Based Cooperative Distributed Antennas With Fractional Frequency Reuse in Multicell Multiuser Networks” (“Xu”) (Ex. 1005)
- 2) TSG-RAN WG1 #42, “Inter-cell Interference Handling for E-UTRA” (“The Ericsson SFR Proposal” or simply “Ericsson”) (Ex. 1007)
- 3) TSG-RAN WG1 #42, “Further Analysis of Soft Frequency Reuse Scheme” (“Huawei”) (Ex. 1006)

- 4) A. Schwartz and K. Lau, “Dynamic Sectorization in a CDMA Cellular System Employing Centralized Base-Station Architecture” (U.S. Patent No. 6,353,600) (“Schwartz”) (Ex. 1008)
- 5) S. Stratford et al., “System and Method for Distributing Wireless Communication Signals Over Metropolitan Telecommunications Networks” (U.S. Patent No. 6,785,558) (“Stratford”) (Ex. 1009)

92. Before proceeding to my analysis of the grounds asserted by the Petitioner, I will provide a brief summary of each of these five references.

**A. The Xu Reference**

93. The Xu reference is a journal paper that was published in the IEEE Transactions on Vehicular Technology.<sup>18</sup> As the title of the paper indicates, Xu

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<sup>18</sup>X. Xu, R. Zhang, S. Ghafoor, and L. Hanzo, “Imperfect Digital-Fiber-Optic-Link-Based Cooperative Distributed Antennas With Fractional Frequency Reuse in Multicell Multiuser Networks,” IEEE Transactions on Vehicular Technology vol. 60, pp. 4439 – 4449 (2011). It is interesting that this paper was published in a journal on vehicular technology – as the paper does not mention vehicular technology or why the content might be relevant to that space.

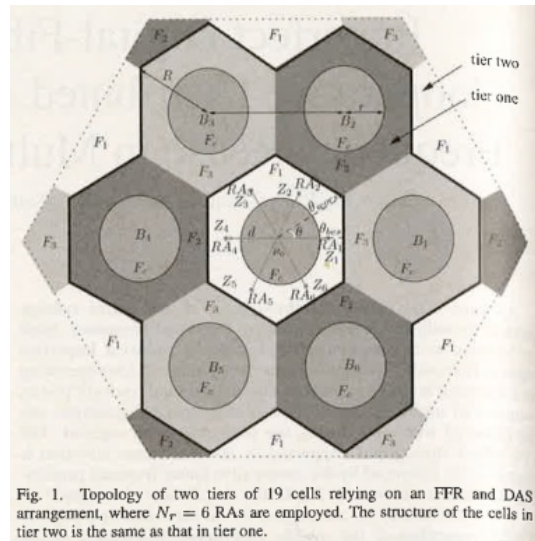
describes a modeling study of what happens when an “imperfect” optical fiber is providing the “wired” connection for a multicell, multiuser wireless network segment. As the paper states in the Introduction<sup>19</sup>,

*Against this backdrop, in the paper, we quantify the attainable throughput across the entire cellular coverage area in a multicell multiuser scenario, when employing cooperative techniques beneficially combined with both realistically models imperfect optical-fiber-aided DASs and FFR. More explicitly, we introduced the split-step Fourier (SSF) method [22] to analyze how the dispersion and nonlinearity of the optical fiber link affect the throughput of the cell-edge area. (Emphasis in the original.)*

94. Notably, the cellular architecture depicted in Xu employs, per cell, a central base station and antenna and six remote antennae units; with the latter serving to provide better signal coverage at the edges of each cell.

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<sup>19</sup> Xu et al., p. 4440, first column.



Note as per the caption that each cell includes six remote antennae (RAs) per cell.

95. The main thrust to Xu is to create model-based analysis of this architecture, as per the quoted paragraph (from Xu) provided above.

## B. The “Ericsson SFR Proposal” Reference

96. The Ericsson SFR Proposal has a formal document title inclusion of TSG-RAN WG1 #42. As this inclusion implies, it was apparently presented to a working group (WG) associated with 3GPP; this working group met in London (UK) on August 29 – September 2, 2005.

97. This proposal offers three possible ideas that can be used to mitigate inter-cell interference in wireless communications: cell-specific scrambling/interleaving for unicast transmission, fractional reuse, and downlink macro diversity; inspection of what this document calls “fractional reuse” indicates a suggestion that is actually what was described earlier as Soft Frequency Reuse

(SFR). Notably, this document does not indicate that these methods are being introduced via this document for the first time; rather, the document provides references to earlier working group documents where the same ideas were apparently suggested.

98. The document provides brief, independent descriptions of each of these three suggestions – and how they might serve to mitigate intercell interference.

99. Interestingly, none of these proposals were adopted; in particular, the technical report (R1-051290) from RAN #42 in 2005 shows that no action was taken to implement the Ericsson frequency reuse proposal – as concerns were expressed regarding “What impact on a future possible LTE standard assuming that such standard would in any way support frequency domain scheduling.”

### **C. The Huawei Reference**

100. The Huawei reference, like the Ericsson SFR Proposal, has a formal document title inclusion of TSG-RAN WG1 #42. As this inclusion again implies, it was apparently presented to the same working group (WG) associated with 3GPP; this working group met in London (UK) on August 29 – September 2, 2005.

101. Huawei is similar to the Ericsson SFR Proposal, in that it contemplates and suggests soft frequency reuse in standard cellular communications networks.

#### **D. The Schwartz Reference**

102. The Schwartz reference is a U.S. Patent entitled “Dynamic Sectorization in a CDMA Cellular System Employing Centralized Base-Station Architecture.” Schwartz describes a CDMA cellular system architecture in which “... centralized traffic channel resources are distributed to remote cells by use of WDM...” (Schwartz at Abstract.)

103. The most-notable aspects of Schwartz is that while this reference does discuss interference within cells, it does not discuss intercell interference; e.g.,

Therefore, when CDMA channels belonging to different PN sequences (i.e., different CDMA signals) are used simultaneously in a cell, cross-interference will occur amongst CDMA channels, which degrades the signal-to noise ratio of channel reception and leads to undesirable soft-handoff. (Schwartz at 2:22-27.)

As just noted, this involves interference within a cell – not intercell interference.

104. Further, Schwartz does not discuss DAS systems, and Schwartz does not discuss the creation of multiple geographic footprints within different frequencies via the use of a single communications unit and a single antenna.

#### **E. The Stratford Reference**

105. The Stratford reference is a U.S. Patent entitled “System and Method for Distributing Wireless Communication Signals Over Metropolitan

Telecommunications Networks.” Stratford’s main innovations claimed over the prior art are the use of digital (rather than analog) optical signals to convey traffic signals from the base station hotel to the remote antenna sites, and the ability to digitize each individual RF traffic signal rather than the entire swath of the broadband RF signal.

The present invention introduces an improved technique for transporting wireless communication signals between a set of base stations in a base Station hotel and a set of remotely located cell sites. In contrast with prior techniques that digitize the entire broadband RF signal associated with each antenna, the present invention proposes a technique that separately digitizes each RF carrier signal within the broadband RF signal. Separately digitizing each RF carrier has significant advantages, such as easing the dynamic range requirements on both the receiver and A/D converter. The separately digitized carriers are transmitted over a digital network between the base station hotel and the remote sites. In contrast with prior techniques, however, the present invention provides a technique wherein the digitized carrier signals are not converted to analog format when they first arrive at the remote site, but remain in digital format as they are distributed within the remote site to the various antenna units of the remote site. In other words, the remote site A/D and D/A converters are terminally located at the antenna units rather than

positioned at an intermediate point in the signal transport path, such as the remote site's interface with the digital network. (Stratford at 2:37-58.)

106. Further, like Schwartz, Stratford does not discuss DAS systems, and Stratford does not discuss the creation of multiple geographic footprints within different frequencies via the use of a single communications unit and a single antenna.

## **XI. ANALYSIS OF PETITIONER'S ASSERTIONS**

107. The Petitioner has provided seven grounds via which to assert that the challenged claims of the '358 are unpatentable. As I will explain below, I disagree with these challenges – and it is my conclusion and opinion that the Petitioner has failed to show that these claims are unpatentable, *and* has failed to demonstrate a reasonable likelihood that at least one challenged claim is unpatentable.

### **A. Ground 1**

108. Grounds 1 - 3 relies on the Xu reference (outlined earlier, in Section XXX) as the primary reference for the Petitioner's assertion of unpatentability. As I will describe below, I disagree with these assertions – and, in fact, it is readily shown that the Petitioner has misconstrued the elements of Claim 7 in an effort to induce Xu to anticipate or render-obvious Claim 7 of the '358 patent. However, a brief examination of Claim 7 and of Xu indicates that without this misconstruing of Claim 7, the Petitioner's challenge clearly fails.

109. Ground 1 asserts anticipation by Xu, while Grounds 2 and 3 assert obviousness based on combination with other references; while I will consider Grounds 2 and 3 separately below, all of the basic conclusions from my analysis of Xu and the Petition's use of Xu will apply to those grounds as well.

110. In the case of Ground 1, the Petitioner asserts that Claims 7, 8, 9, and 11 of the '358 patent are anticipated by Xu; from my analysis of Xu and the Petition, it is my conclusion and opinion that this assertion by the Petitioner is incorrect.

111. The key elements of Claim 7 of the '358 patent are:

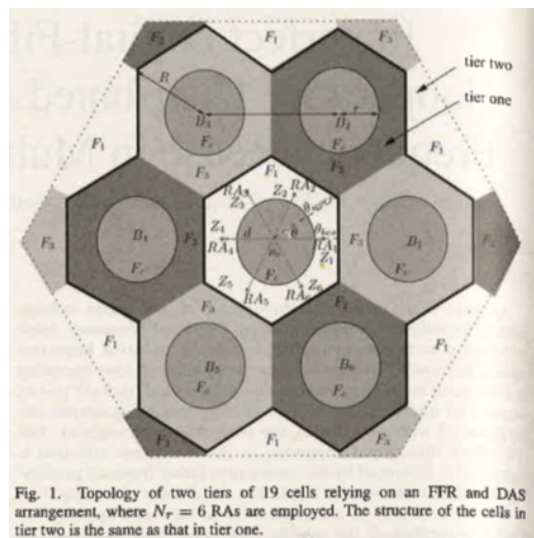
... transmitting and receiving, from *a first communications unit* of the set of communications units... (emphasis added).

... transmitting and receiving, from *a second communications unit* of the set of communications units... (emphasis added).

112. As these two claim elements make clear, in Claim 7, the two separate sets of frequencies in a particular (first or second) geographic footprint are created-and-managed by *a single communications unit* in each (first and second) such geographic footprint. As noted above, the Petitioner has attempted to overcome this obvious problem (with their assertions) by citing particular embodiments in the specification which are *not* described by Claim 7 – since, as also noted above, the

cited references (such as Xu) clearly do not anticipate or render-obvious Claim 7 of the ‘358 patent.

113. This can readily be seen via a simple examination of Figure 1 of the Xu reference.<sup>20</sup>



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<sup>20</sup>Here, I have included Figure 1 from the Xu reference in an unannotated form; in the Petition (on p. 22), the Petitioner has annotated Figure 1 of Xu to include ... - but has not stated that these are annotations that do *not* appear in Figure 1 Xu; the graphic labeled “Radio Frequencies” in the Petition’s figure does not appear in Figure 1 of Xu, and no information is provided regarding its actual origin. This problem (of annotations that are not described as such) occurs with another figure in the Petition, as I will explain later when the associated reference is discussed.

114. As is shown in Figure 1 of Xu and as further-detailed in the associated figure caption, Xu describes an architecture in which six RAs (remote antennae) – which the Petitioner identifies as one or more communications units – are used to provide the “second geographic footprint” in the edge regions of each cell. However, this is facially not the same thing as the single communications unit described in Claim 7 of the ‘358 patent – where a *single* communications unit provides the two geographic footprints.

115. For this reason alone, Xu fails to either anticipate or render-obvious Claim 7 of the ‘358 patent – and for this reason, Grounds 1 – 3 fail.<sup>21,22</sup>

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<sup>21</sup>It should be noted here that an earlier Petition challenging largely the same claims (including Claim 7) of the ‘358 patent was denied institution by the PTAB – on the ground that that Petitioner’s primary reference, Fujii, failed to render the challenged claims of the ‘358 patent unpatentable – as the Board concluded that the Petition was deficient as it did not “address or explain the operation or transmission from any single antenna in Fujii, which describes the operation of multiple antennas per cell . . . .” Ex. 1025 at 22. As Fujii and Xu involve the same system architecture (of multiple communications units to produce two geographic footprints), Xu fails for the same reason.

<sup>22</sup>In more detail, notably, in that earlier Petition to the PTAB regarding the ‘358 patent, the main reference used by (with respect to Claim 7 and other claims of the ‘358 patent) was a paper that was published in the IEICE Transactions on Communications: M. 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 (2010). The architecture disclosed in this paper involves multiple antennae in each cell in order to implement sub-functions within a single cell. As the ‘358 patent explicitly teaches the use of

116. In addition, Xu *mentions* FFR (fractional frequency reuse) – but then says nothing about either its usage or its implementation.<sup>23,24</sup> Further to that point, Xu does not disclose (or claim to disclose) any new-or-novel wireless communications architecture – instead, providing a known system architecture and then providing an analysis of that known system under particular circumstances.<sup>25</sup>

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*one* antenna per cell (with the frequency reuse techniques being implemented via different transmit power levels – as detailed in Section IX.A), this argument was rejected by the PTAB, with the PTAB choosing to not even initiate proceedings against the ‘358 patent.

<sup>23</sup>It should again be noted that in the Petition, at p. 22, the Petitioner has added an annotation to Figure 1 of Xu, describing “Radio Frequencies”; however, as noted above, this addition does not appear in Xu, its origins are unstated, and the annotation of Figure 1 is not described as “annotated” in the Petition.

<sup>24</sup>It should be noted here that the patentee (of the ‘358 patent) does not claim that frequency reuse techniques are inventive material of the ‘358 patent – and, in fact, states this quite explicitly. This aspect of the prior art and of the ‘358 patent will be considered in more detail in Section XI.D.

<sup>25</sup>As noted in Section X.1, the Xu reference is a journal paper from a university research group in the U.K. (the University of Southampton) – and thus the paper

This is made clear by the title of the paper by Xu et al., and the purpose of the paper is stated quite clearly in the Introduction section<sup>26</sup>:

*Against this backdrop, in the paper, we quantify the attainable throughput across the entire cellular coverage area in a multicell multiuser scenario, when employing cooperative techniques beneficially combined with both realistically models imperfect optical-fiber-aided DASs and FFR. More explicitly, we introduced the split-step Fourier (SSF) method [22] to analyze how the dispersion and nonlinearity of the optical fiber link affect the throughput of the cell-edge area. (Emphasis in the original.)*

117. Further, Xu does not even mention either intercell interference or the creation of two geographic footprints from a single communications unit using a single antenna; Xu clearly teaches away from the ‘358 patent.

118. For these further reasons, Xu fails to either anticipate or render-obvious Claim 7 of the ‘358 patent; further, as Xu is simply inapplicable to independent Claim 7, Xu is also simply inapplicable to the dependent claims (from

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does not need to rise to the requirement of disclosing and describing inventive material – as would be the case for a patent.

<sup>26</sup>Xu et al., p. 4440, first column.

Claim 7) Claim 8, 9, and 11 of the ‘358 patent. As Xu does not disclose Claim 7 of the ‘358 patent, Xu does not disclose Claim 8, Claim 9, or Claim 11 of the ‘358 patent.

119. For these reasons, Ground 1 fails.

**B. Ground 2**

120. Ground 2 asserts that Claims 8, 15, 20, and 21 are rendered obvious based on a combination of Xu and Schwartz; however, this ground also fails – largely for the reasons discussed above.

121. First, as detailed above, Xu does not discuss the key inventive aspects of the ‘358 patent – in particular, as just discussed, the use of a single communications unit to create two separate geographic footprints. Since, as mentioned above, Xu teaches away from the ‘358 patent, it is difficult to see how *any* combination with Xu could provide an obviousness argument – as there are no specific deficiencies in Xu that another reference (or references) would provide, since the “deficiencies” in Xu are not specific but general (that is, Xu is a total mismatch with the ‘358 patent).

122. Second, in Ground 2 the Petitioner asserts Schwartz as the combination reference. However, Schwartz fails to correct the deficiencies of Xu. First, as just noted, as the Xu reference itself is totally deficient, any reference used for combination would have to be capable, *entirely on its own*, of disclosing all the

challenged claim elements of the ‘358 patent. As detailed in the overview presented earlier (in Section X.4), Schwartz describes a CDMA cellular system architecture in which “... centralized traffic channel resources are distributed to remote cells by use of WDM...” Further, while Schwartz does discuss interference within cells, it does not discuss intercell interference; Schwartz also does not discuss does not discuss DAS systems, and Schwartz does not discuss the creation of multiple geographic footprints within different frequencies via the use of a single communications unit and a single antenna. These are key aspects of what is disclosed in the ‘358 patent – and as neither Xu nor Schwartz disclose the aspects of the ‘358 patent, the combination of Xu and Schwartz fails to render Claims 8, 15, 20, and 21 of the ‘358 patent obvious.

123. Schwartz is only peripherally-related to the teachings of the challenged claims of the ‘358 patent – which, as detailed above, involve the creation of two geographic footprints via a single communications unit (and the concomitant mitigation of intercell interference, among other benefits). As Schwartz does not disclose this material (either in general or with specific-respect to the challenged claims of the ‘358 patent), Ground 2 fails.

124. In slightly more detail, Ground 2 differs from Ground 1 in the claims that the Petitioner is challenging. With respect to Claim 8, Claim 8 is a dependent claim from Claim 7 – and on that ground alone, for the reasons described above,

Ground 2 fails with respect to Claim 8. With respect to Claim 15, Claim 15 is the apparatus claim that is associated with the method that is disclosed in Claim 7 – a claim which has already been discussed extensively above. For same reasons that Ground 1 fails with respect to Claim 7 and for the additional reasons discussed above (with regard to Schwartz not even matching up with Xu, let alone remedying the deficiencies in Xu), the combination of Xu and Schwartz fails to disclose Claim 15 of the ‘358 patent.

125. With respect to Claim 20 and Claim 21, these claims are dependent from Claim 15; on that ground alone, the combination of Xu and Schwartz fails to disclose them.

126. For all of these reasons, Ground 2 fails.

### **C. Ground 3**

127. Ground 3 asserts that Claims 17 and 18 are rendered obvious based on a combination of Xu and Huawei; however, this ground also fails – largely for the reasons discussed above.

128. First, Claims 17 and 18 are dependent claims from Claim 15. As we discussed above (in the discussion of Ground 2), Claim 15 is the apparatus claim that is associated with the method claim of Claim 7; as detailed above therein, Xu fails to disclose Claim 15 of the ‘358 patent – for the same reasons that Xu fails to

disclose Claim 7 of the ‘358 patent. On this alone, the combination of Xu and Huawei fails to disclose Claim 17 and Claim 18 of the ‘358 patent.

129. In further detail, as explained above (with respect to Ground 1 and Ground 2) , Xu does not discuss the key inventive aspects of the ‘358 patent – in particular, as just discussed, the use of a single communications unit to create two separate geographic footprints. Since, as mentioned above, Xu teaches away from the ‘358 patent, it is difficult to see how *any* combination with Xu could provide an obviousness argument – as there are no specific deficiencies in Xu that another reference (or references) would provide, since the “deficiencies” in Xu are not specific but general (that is, Xu is a total mismatch with the ‘358 patent).

130. In Ground 3 the Petitioner asserts Huawei as the combination reference via which to challenge Claim 17 and Claim 18; however, this effort fails.

131. As an initial matter, it appears that the Petitioner has not actually met the requirement to demonstrate that the Huawei reference even properly qualifies as prior art. The Petitioner has not shown that a POSA would have been able to readily access this document. The Huawei reference was one of thousands of documents that were deposited onto the 3GPP FTP site – but there is no search function supplied that might allow a user – using particular keywords – to find this document. As such, with no inside-the-document details available, it is unclear if a typical search engine would be able to find the Huawei reference. Without pre-existing knowledge

of both the existence and the contents of the Huawei reference, it is unclear that a POSA would readily be able to find this document – and the Petitioner has failed to sufficiently-demonstrate otherwise.

132. Returning to the technical content aspects, Huawei fails to correct the deficiencies of Xu. First, as just noted, as the Xu reference itself is totally deficient, any reference used for combination would have to be capable, *entirely on its own*, of disclosing all the challenged claim elements of the ‘358 patent. Strangely, the Petitioner does not even attempt to assert that Huawei discloses any of the claim elements of Claim 15 (let alone all of them) – but only attempts to invoke Huawei against Claim 17 and Claim 18. However, as neither Xu nor Huawei (either alone or in combination) render Claim 15 obvious, neither Xu nor Huawei (either alone or in combination) render Claim 17 and Claim 18 obvious.

133. For these reasons, Ground 3 fails.

#### **D. Ground 4**

134. As was the case with Grounds 1 – 3, Grounds 4 – 6 can also be grouped together for convenience. In this case, these grounds all rely (as their primary reference) on the Ericsson reference – which was described in overview form in Section X.2 above – for the Petitioner’s assertion of unpatentability. As I will describe below, I disagree with these assertions – and, in fact, once again it is readily shown that (as was the case with Xu) the Petitioner has misconstrued the elements

of Claim 7 in an effort to induce Ericsson to anticipate or render-obvious Claim 7 of the ‘358 patent. However, a brief examination of Claim 7 and of Ericsson indicates that without this misconstruing of Claim 7, the Petitioner’s challenge clearly fails.

135. As an initial matter, it appears that the Petitioner has not actually met the requirement to demonstrate that the Ericsson reference even properly qualifies as prior art. The Petitioner has not shown that a POSA would have been able to readily access this document. The Ericsson reference was one of thousands of documents that were deposited onto the 3GPP FTP site – but there is no search function supplied that might allow a user – using particular keywords – to find this document. As such, with no inside-the-document details available, it is unclear if a typical search engine would be able to find the Ericsson reference. Without pre-existing knowledge of both the existence and the contents of the Ericsson reference, it is unclear that a POSA would readily be able to find this document – and the Petitioner has failed to sufficiently-demonstrate otherwise.

136. Returning to the ‘358 patent, the key elements of Claim 7 of the ‘358 patent are:

... transmitting and receiving, from *a first communications unit* of the set of communications units... (emphasis added)

... transmitting and receiving, from *a second communications unit* of the set of communications units...  
(emphasis added)

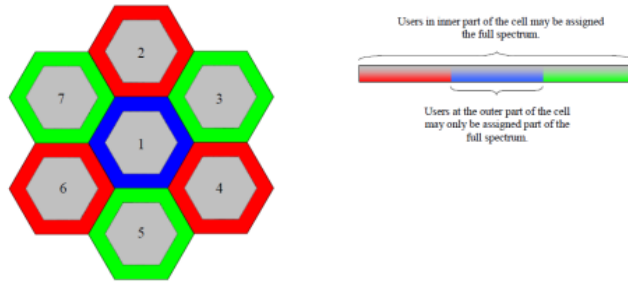
137. In the same vein as was detailed above with respect to Xu, these two claim elements (of the ‘358 patent) make clear that, in Claim 7, the two separate sets of frequencies in a particular (first or second) geographic footprint are created-and-managed by *a single communications unit* in each (first and second) such geographic footprint. As also noted above, the Petitioner has attempted to overcome this obvious problem (with their assertions) by citing particular embodiments in the specification which are *not* described by Claim 7 – since, as also noted above, the cited references (such as the Ericsson reference) clearly do not anticipate or render-obvious Claim 7 of the ‘358 patent.

138. As discussed in Section X.2, the Ericsson SFR proposal discusses methods of mitigating intercell interference – and as also discussed in Section X.2, offers three different proposals for addressing that problem; one of these three proposals is “fractional reuse” – though inspection of the proposal shows that this particular idea corresponds to Soft Frequency Reuse (SFR), which was discussed and explained in the overview of the ’358 patent (Section IX.A). From that section

of the Ericsson SFR proposal, the Petitioner excerpts Figure 2, and asserts that this figure (and the associated text) anticipates Claim 7 of the '358 patent.<sup>27</sup>

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<sup>27</sup>It should be noted here that, as was the case with the Petitioner's presentation of Figure 1 from Xu, annotated versions of Figure 2 (from the Ericsson SFR proposal) and parts of Figure 2 have been annotated by the Petitioner – without any acknowledgment that the figure has been annotated. The figure on p. 48 is the unannotated Figure 2 from that document – and as can be seen, is identical to the unannotated Figure 2 from that document that is included in this Declaration (just below). However, as can be seen by comparing the (unannotated) figure with the Petitioner's figures on pp. 49 – 61 of the Petition, the Petitioner has added details to the Ericsson Figure 2 that are not present in the original figure – and, also once again, the origin of this additional material is not stated. In particular, in the figure on p. 49 of the Petition, annotations are added to cells (on the left side of the figure) that are not present in the Ericsson reference; in addition the frequency-allocation sub-diagram that appears on the right side of the figure does not appear in the Ericsson reference at all – and its origins are unknown.



139. I disagree with this assertion for two reasons – and note is addition that these two reasons for this failure are of salient note.

140. First, as was explained in Section IX.A, various frequency reuse schemes (including the three types mentioned in the '358 patent – Hard Frequency Reuse (HFR), Fractional Frequency Reuse (FFR), and Soft Frequency Reuse (SFR)) are acknowledged by the inventors of the '358 patent as being prior art that was known in the general art – and the inventors do not claim to have invented these frequency reuse approaches.<sup>28</sup>

141. Thus, the Ericsson SFR proposal's depiction of frequency reuse is actually another source confirming that these approaches are prior art, as so-stated in the '358 patent. For example, to reprise part of an excerpt that was provided in Section IX.A,

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<sup>28</sup>Notably, the Ericsson SFR proposal does not claim these frequency usage techniques as being inventive, and the document includes footnotes to older documents referencing the ideas.

In order to mitigate this interference, a number of techniques have recently been proposed, e.g. the Soft Frequency Reuse (SFR) scheme... ('358 patent at 5:49-51.)

The '358 patent is not claiming frequency reuse techniques as inventive material; the Ericsson SFR proposal is simply another source that is showing that prior art. For that reason alone, the Ericsson SFR proposal cannot anticipate Claim 7 of the '358 patent, because Claim 7 covers more than the prior art frequency reuse technique – it claims the performance of frequency reuse in a DAS using a single antenna unit to create the two footprints that are required to practice frequency reuse.

142. Second, it is notable that the title of the '358 patent is “Method and System for *Soft Frequency Reuse* in a *Distributed Antenna System*.” (Emphasis added.) As was explained in the overview of the '358 patent provided (in Section IX.A), the '358 patent discloses a unique network architecture that combines a DAS network with frequency reuse techniques – and includes extensive details about how that uniquely-architected network can be most-effectively operated.

143. As was explained in Section IX.A, the '358 patent very-specifically teaches an architecture in which each cell has a single DRU – as can readily be seen in Figure 2 of the '358 patent.

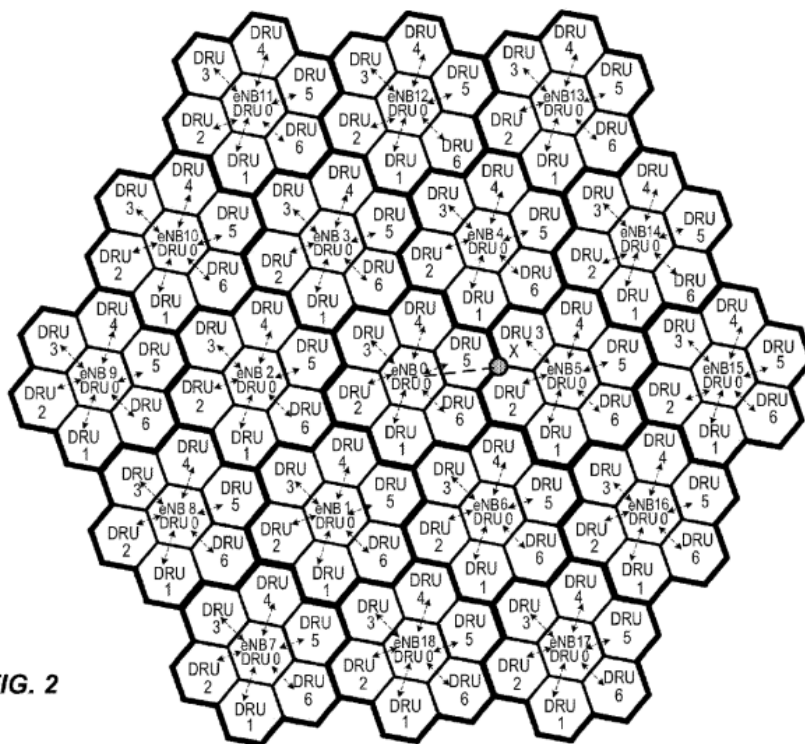


FIG. 2

In contrast, there is considerable amount of art that teaches different approaches – for example, in which, in order to implement sub-functions within a single cell, a single cell contains multiple transceiving antennae that are distributed throughout each cell.<sup>29</sup> The '358 patent teaches a new-and-different architecture – in which

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<sup>29</sup>Notably, in the earlier Petition to the PTAB regarding the '358 patent, the main reference used by the Petitioner (with respect to Claim 7 and other claims of the '358 patent) was a paper that was published in the IEICE Transactions on Communications: M. Fujii, “User Scheduling for Distributed-Antenna Zero-Forcing Beamforming Downlink Multiuser MIMO-OFDM Systems,” IEICE Transactions

frequency-reuse techniques are combined with DAS network technology, with this inventive network being optimized for best operational functionality.

144. In contrast, the Ericsson SFR proposal is silent on these architectural details— and contains no information on any particular architecture. The cell depiction in Figure 2 of the Ericsson SFR Proposal says nothing about the architecture of the system that will actually be providing the communications services to the cells – such as whether each cell will have a single DRU or multiple DRUs, with (respectively) a single transceiving antenna per cell or multiple transceiving antennae per cell... or some other architecture entirely. In contrast to Claim 7 of the ‘358 patent, the Ericsson SFR proposal does not disclose any “communications units” at all. As the Ericsson SFR proposal does not disclose these

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on Communications vol. E93-B, No. 9, pp. 2370 – 2380 (2010). The architecture disclosed in this paper involves multiple antennae in each cell in order to implement sub-functions within a single cell. As the ‘358 patent explicitly teaches the use of *one* antenna per cell (with the frequency reuse techniques being implemented via different transmit power levels – as detailed in Section IX.A), this argument was rejected by the PTAB, with the PTAB choosing to not even initiate proceedings against the ‘358 patent.

teachings of Claim 7 of the '358 patent, it cannot anticipate or render-obvious Claim 7 of the '358 patent.

145. Further to that point, it is also my opinion and conclusion that the Ericsson SFR Proposal fails to meet the requirement (discussed in Section VII.B) that a prior art reference be enabling and enabled. As was just explained above, the Ericsson reference provides an SFR proposal – but is completely silent when it comes to architectural details and implementation details. Nothing is provided to indicate if the architecture/implementation of the proposal is to be done with a single communications unit per cell, multiple communications units per cell, or something else entirely – and so this detail is unknown from the proposal document. Further, as also noted above, the proposal does not discuss communications units at all – and does not consider implementation details at all, such as if the architecture would involve a conventional cellular system, a DAS system, or something else entirely; in particular, the proposal thus obviously does not describe how to deploy frequency reuse in a DAS system. Thus, a POSA (as described in Section V) would not be able to use the brief (two-paragraph) discussion in the proposal to create a working DAS system that employs one of the frequency reuse approaches detailed in the '358 patent (such as FFR or SFR). The Ericsson SFR proposal is not enabled.

146. Finally, to repeat what was noted earlier, Fujii was the main reference that was used by another Petitioner in its Petition to the PTAB regarding the '358

patent – and (as also noted earlier) the PTAB denied institution of that Petition, for the reasons that were also explained earlier. Of particular note, the PTAB found (and I agree with their conclusion) that as Fujii does not disclose two geographic footprints each with different frequencies emanating from a single DRU (as required by Claim 7), Fujii does not disclose Claim 7; it is notable that Fujii discloses a rather-different architecture, in which multiple antenna units are placed throughout a single cell. Fujii does not disclose a DAS system; rather, Fujii discloses the use of a conventional cellular communications system, with large-scale “cell towers.”

147. The Ericsson SFR proposal does not even delve into the level of detail provided by Fujii – and thus fails to disclose *any* architectural details regarding the wireless system architecture in which the Ericsson SFR proposal would be implemented – let alone one specially-identified by the PTAB as being different from the architecture disclosed in the ‘358 patent.

148. For these reasons, the Ericsson SFR proposal fails to either anticipate or render-obvious Claim 7 of the ‘358 patent.

149. Further, as Ericsson is simply inapplicable to independent Claim 7, the Ericsson SFR Proposal is also simply inapplicable to the dependent claims (from Claim 7) Claim 9 and 11 of the ‘358 patent. As Ericsson does not disclose Claim 7 of the ‘358 patent, Ericsson does not disclose Claim 9 or Claim 11 of the ‘358 patent.

150. Thus, Ground 4 fails.

## **E. Ground 5**

151. Ground 5 of the Petition asserts that Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 are rendered obvious by Ericsson in combination with Schwartz; however, this ground also fails – largely for the reasons discussed above.

152. As an initial matter, Ground 5 (as is also the case with Ground 6 and Ground 7) is asserted against a very large number of claims – in fact, these three grounds are asserted against *all* of the claims that the Petitioner is challenging. However, as noted above, only two independent claims (Claims 7 and 15) are in play – with Claims 8, 9, and 11 being dependent from Claim 7, and Claims 17, 18, 20, and 21 being dependent from Claim 15. Further, as was also noted earlier, Claim 15 is the apparatus claim that is associated with the method claim Claim 7; thus, as detailed above, all analysis with respect to either Claim 7 or Claim 15 applies equally to the other.

153. First, as detailed above, the Ericsson SFR proposal does not discuss the key inventive aspects of the ‘358 patent – in particular, as just discussed, the use of a single communications unit to create two separate geographic footprints. Since, as mentioned above, the Ericsson SFR proposal does not teach *any* system architecture (that is, in contrast to Claim 7 of the ‘358 patent, the Ericsson SFR proposal does not disclose any “communications units” at all, and in further contrast to Claim 15 of the ‘358 patent, the Ericsson SFR Proposal does not disclose “host

units” at all), the Ericsson SFR proposal does not disclose these teachings of either Claim 7 or Claim 15 of the ’358 patent – and therefore it cannot anticipate or render-obvious either Claim 7 or Claim 15 of the ’358 patent. Further, it is difficult to see how *any* combination with the Ericsson SFR proposal could provide an obviousness argument – as there are no specific deficiencies in the Ericsson SFR proposal that another reference (or references) would address, as the “deficiencies” in the Ericsson SFR proposal are not specific but general (that is, the Ericsson SFR proposal is a total mismatch with regard to the ’358 patent).

154. Second, in Ground 5 the Petitioner asserts Schwartz as the combination reference. However, Schwartz fails to correct the deficiencies of Ericsson. First, as just noted, as the Ericsson reference itself is deficient, any reference used for combination would have to be capable, *entirely on its own*, of disclosing all the challenged claim elements of the ’358 patent. As detailed in the overview presented earlier (in Section X.4), Schwartz describes a CDMA cellular system architecture in which “... centralized traffic channel resources are distributed to remote cells by use of WDM...” Further, while Schwartz does discuss interference within cells, it does not discuss intercell interference; Schwartz also does not discuss does not discuss DAS systems, and Schwartz does not discuss the creation of multiple geographic footprints within different frequencies via the use of a single communications unit and a single antenna. These are key aspects of what is disclosed

in the ‘358 patent – and as neither Ericsson nor Schwartz disclose the aspects of the ‘358 patent, the combination of Ericsson and Schwartz fails to render Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 of the ‘358 patent obvious.

155. Schwartz is only peripherally-related to the teachings of the challenged claims of the ‘358 patent – which, as detailed above, involve the creation of two geographic footprints via a single communications unit (and the concomitant mitigation of intercell interference, among other benefits). As Schwartz does not disclose this material (either in general or with specific-respect to the challenged claims of the ‘358 patent), Ground 5 fails.

156. With respect to Claim 15, Claim 15 is the apparatus claim that is associated with the method that is disclosed in Claim 7 – a claim which has already been discussed extensively above. For same reasons that Ground 5 fails with respect to Claim 7 and for the additional reasons discussed above (with regard to Schwartz not even matching up with Ericsson, let alone remedying the deficiencies in Ericsson), the combination of Ericsson and Schwartz fails to disclose Claim 15 of the ‘358 patent.

157. With respect to Claim 8, Claim 9, and Claim 11, these claims are dependent from Claim 7; on that ground alone, the combination of Ericsson and Schwartz fails to disclose them.

158. With respect to Claim 17, Claim 18, Claim 20, and Claim 21, these claims are dependent from Claim 15; on that ground alone, the combination of Ericsson and Schwartz fails to disclose them.

159. For all of these reasons, Ground 5 fails.

**F. Ground 6**

160. Ground 6 of the Petition asserts that Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 are rendered obvious by Ericsson in combination with Stratford; however, this ground also fails – largely for the reasons discussed above.

161. As an initial matter, Ground 6 (as is also the case with Ground 5 and Ground 7) is asserted against a very large number of claims – in fact, these three grounds are asserted against *all* of the claims that the Petitioner is challenging. However, as noted above, only two independent claims (Claims 7 and 15) are in play – with Claims 8, 9, and 11 being dependent from Claim 7, and Claims 17, 18, 20, and 21 being dependent from Claim 15. Further, as was also noted earlier, Claim 15 is the apparatus claim that is associated with the method claim Claim 7; thus, as detailed above, all analysis with respect to either Claim 7 or Claim 15 applies equally to the other.

162. First, as detailed above, the Ericsson SFR proposal does not discuss the key inventive aspects of the ‘358 patent – in particular, as just discussed, the use of a single communications unit to create two separate geographic footprints. Since,

as mentioned above, the Ericsson SFR proposal does not teach *any* system architecture (that is, in contrast to Claim 7 of the ‘358 patent, the Ericsson SFR proposal does not disclose any “communications units” at all, and in further contrast to Claim 15 of the ‘358 patent, the Ericsson SFR Proposal does not disclose “host units” at all), the Ericsson SFR proposal does not disclose these teachings of either Claim 7 or Claim 15 of the ‘358 patent – and therefore it cannot anticipate or render-obvious either Claim 7 or Claim 15 of the ‘358 patent. Further, it is difficult to see how *any* combination with the Ericsson SFR proposal could provide an obviousness argument – as there are no specific deficiencies in the Ericsson SFR proposal that another reference (or references) would address, as the “deficiencies” in the Ericsson SFR proposal are not specific but general (that is, the Ericsson SFR proposal is a total mismatch with regard to the ‘358 patent).

163. Second, in Ground 6 the Petitioner asserts Stratford as the combination reference. However, Stratford fails to correct the deficiencies of Ericsson. First, as just noted, as the Ericsson reference itself is deficient, any reference used for combination would have to be capable, *entirely on its own*, of disclosing all the challenged claim elements of the ‘358 patent. As detailed in the overview presented earlier (in Section X.5), Stratford describes the use of digital (rather than analog) optical signals to convey traffic signals from the base station hotel to the remote antenna sites, and the ability to digitize each individual RF traffic signal rather than

the entire swath of the broadband RF signal. This is very different than what is disclosed in the ‘358 patent – and on that alone, the combination of Ericsson and Stratford fails to render Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 of the ‘358 patent obvious.

164. Stratford is only peripherally-related to the teachings of the challenged claims of the ‘358 patent – which, as detailed above, involve the creation of two geographic footprints via a single communications unit (and the concomitant mitigation of intercell interference, among other benefits). As Stratford does not disclose this material (either in general or with specific-respect to the challenged claims of the ‘358 patent), Ground 6 fails.

165. With respect to Claim 15, Claim 15 is the apparatus claim that is associated with the method that is disclosed in Claim 7 – a claim which has already been discussed extensively above. For same reasons that Ground 5 fails with respect to Claim 7 and for the additional reasons discussed above (with regard to Stratford not even matching up with Ericsson, let alone remedying the deficiencies in Ericsson), the combination of Ericsson and Stratford fails to disclose Claim 15 of the ‘358 patent.

166. With respect to Claim 8, Claim 9, and Claim 11, these claims are dependent from Claim 7; on that ground alone, the combination of Ericsson and Stratford fails to disclose them.

167. With respect to Claim 17, Claim 18, Claim 20, and Claim 21, these claims are dependent from Claim 15; on that ground alone, the combination of Ericsson and Stratford fails to disclose them.

168. For all of these reasons, Ground 6 fails.

#### **G. Ground 7**

169. Ground 7 of the Petition asserts that Claims 7, 8, 9, 11, 15, 17, 18, 20, and 21 are rendered obvious by Stratford in combination with Ericsson; however, this ground also fails – largely for the reasons discussed above.

170. Of particular note, Ground 7 is basically the same as Ground 6 – with the only change being that the primary reference and the combination reference are swapped from their positions in Ground 6. Thus, Ground 7 is, for all intents and purposes the same as Ground 6 – and thus, Ground 7 fails for the same reasons that Ground 6 fails, as discussed above in the previous section.

## **XII. SUMMARY AND CONCLUSIONS**

171. It is my opinion that Claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 of the '358 patent are valid – substantially for the reasons discussed above. Further, the Petitioner has failed to show that these claims are unpatentable – for the reasons detailed above.

172. For the foregoing reasons based on my analysis provided in this Declaration, it is my opinion that the Petitioner has not offered clear and convincing

evidence that any of the contested claims (that is, Claims 7, 8, 9, 11, 15, 17, 18, 20 and 21) of the '358 patent are unpatentable. I therefore conclude that the asserted claims of the '358 patent are valid.

173. Thus, the Petitioner failed to demonstrate that there is a reasonable likelihood that the Petitioner will be able to show, via Grounds 1 – 7, that the challenged claims of the '358 Patent are unpatentable. Therefore, the Board should deny institution of *inter partes* review of the '358 Patent.

174. The opinions in this Declaration are my current opinions and are based on information available at the time of this Declaration. I reserve the right to amend or supplement my opinions to address any further information that becomes available relating to the validity of the '358 patent.



Date: April 26, 2023

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Daniel P. Foty

### **CERTIFICATE OF SERVICE**

I hereby certify that on April 26, 2023, I caused the foregoing to be served on all counsel of record via email.

/David D. Schumann/  
David D. Schumann