UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., AND
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioners,

v.

HANNIBAL IP LLC,

Patent Owner.

Case IPR2025-01187
U.S. Patent No. 11,057,896

DECLARATION OF HARRY V. BIMS, PH.D.

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I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc., (collectively "Petitioners") as a technical expert in connection with a petition for *inter partes* review ("IPR") of U.S. Patent No. 11,057,896 ("the '896 patent," Ex. 1001). I understand that the '896 patent is assigned to Hannibal IP, LLC ("Hannibal" or "Patent Owner").

2. I am over 21 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein.

3. I am being compensated for my time in this matter at an hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this matter. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this matter. I have no personal or financial stake or interest in the outcome of the present proceeding.

4. I understand that this proceeding involves U.S. Patent No. 11,057,896 ("the '896 patent," Ex. 1001). The application for the '896 patent was filed October 22, 2019, as U.S. Patent Application No. 16/660,726 ("the '726 application"). The '896 patent claims priority to U.S. Provisional application No. 62/754,165, filed on November 1, 2018. Ex. 1001, Cover.

5. I have been asked, by counsel for Petitioners, to provide opinions based on my experience with and expertise in wireless communication technologies. In particular, I have been asked to offer opinions regarding the patentability of claims 1-19 of the ’896 patent (the “Challenged Claims”) in view of certain prior art references and the knowledge of a person of ordinary skill in the art (“POSITA”). My opinions are set forth below.

6. I have been asked by Petitioners to provide my opinion whether the Challenged Claims of the ’896 patent would have been obvious to a POSITA at the time of the earliest priority date of the ’896 patent. In performing my analysis, I have been asked to assume that the earliest priority date of the Challenged Claims of the ’896 patent is the earliest claimed priority date, namely November 1, 2018.

7. Throughout this declaration, I refer to specific pages, figures, and/or line numbers of various exhibits. These citations are illustrative and are not intended to suggest that they are the only support for the propositions for which they are cited.

II. SUMMARY OF OPINIONS

8. This declaration considers claims 1-19 of the ’896 patent. Below, I set forth the opinions I have formed, the conclusions I have reached, and the bases for these opinions and conclusions. I believe the statements contained in this declaration to be true and correct to the best of my knowledge.

9. Based on my experience, knowledge of the art at the time of the applicable priority date (I was told to assume a priority date of November 1, 2018), it is my opinion that claims 1-19 of the ’896 patent would have been obvious based on the asserted grounds discussed below.

10. I am being compensated for my time at my normal hourly rate. My compensation is in no way contingent upon the nature of my findings, the presentation of my findings in testimony, or the outcome of this proceeding.

III. QUALIFICATIONS AND PROFESSIONAL BACKGROUND

11. I believe that I am well qualified to serve as a technical expert in this matter based upon my qualifications, discussed in detail below. A copy of my curriculum vitae is included as Exhibit 1004.

12. Based on my education, research, and work experience, I am knowledgeable about the subject matter of the ’896 patent and the related prior art.

13. For more than 35 years, since approximately 1985, I have studied, designed, and worked in the field of telecommunications, including wireless communications. During this period, I have designed and implemented various products involving cellular communication technology.

14. I received a B.S. in Computer and Systems Engineering from Rensselaer Polytechnic Institute in 1985. I received an M.S. in Electrical Engineering in 1988 and a Ph.D. in Electrical Engineering in 1993, both from

Stanford University. As a graduate student, I studied the principle of Digital Communications theory, including data modulation and demodulation, signal constellations and lattices, channel estimation, equalization, filtering, precoding, synchronization, and trellis coding. My Ph.D. thesis addressed the application of trellis coding and precoding to a digital modulation system, and was titled "Trellis Coding for Multi-Level, Partial Response Continuous Phase Modulation with Precoding."

15. After receiving my Ph.D. in 1993, I worked for Glenayre Technologies—Wireless Access Group, where I worked on applications for wireless communication, including inventing, designing, and building a patented two-way pager test system and co-developing a wireless application protocol.

16. In January of 1999, I launched a technology consulting company, Protocomm Systems Inc., which focuses on the development of advanced wireless communications protocols and related software implementations for wireless product companies.

17. From 1999 to 2001, I was also the Director of Software Architecture for Symmetry Communications Systems, a technology company that produced SGSN and GGSN core network infrastructure for 2.5G wireless carrier networks. In this position, I was responsible for the software architecture for core SGSN (Serving GPRS Support Node) and GGSN (Gateway GPRS Support Node)

products for the GPRS (Generic Packet Radio Services) market. I also held management responsibility for the Firmware, Hardware, Performance, and Systems Engineering Groups.

18. In 2001, I developed a business plan for building network infrastructure for Institute of Electrical and Electronics Engineers ("IEEE") 802.11 standard ("Wi-Fi") enterprise networks, and then later that year founded AirFlow Networks, Inc. At this company, I invented and received eleven patents on a distributed antenna system design for wireless networks based on the 802.11 wireless local area network specification.

19. I am currently the President of Protocomm Systems, LLC and Bims Laboratories, LLC, both of which I founded. As the President of Bims Laboratories, I have performed technical research in wireless technology standards, such as UMTS, LTE/4G, 5G, Wi-Fi, Bluetooth, and other network communication protocols. I am named as an inventor of twenty-five telecommunications related patents.

20. In addition, I am a named Technical Expert and former Vice-Chair and Secretary of the IEEE 802.16 Working Group, which develops technical standards for the wireless protocol commonly known as WiMax. I am also a voting member of the IEEE 802.11 Working Group (which develops technical standards for WiFi), and the IEEE 802.15 Working Group (which develops standards for a

variety of specialty wireless networks). Within the IEEE 802.15 Working Group, I am the technical editor for IEEE 802.16t, an amendment to the WiMAX standard that supports long-range wireless networks for the railroad industry. Within the IEEE 802.11 Working Group, I routinely participate and vote on discussions relating to the design of wireless communications, including packet prioritization, transmission, acknowledgment, and retransmission.

IV. MATERIALS CONSIDERED

21. In forming my opinions, I have reviewed the following documents, and any other document cited in this declaration.

Exhibit	Description
Ex. 1001	U.S. Patent No. 11,057,896 to Cheng et al. ("the '896 patent")
Ex. 1002	File History for U.S. Patent No. 11,057,896
Ex. 1005	U.S. Patent Application Publication No. US 2018/0343653 A1 to Guo ("*Guo*")
Ex. 1006	3GPP TSG RAN WG1 Meeting #94bis R1-1810751 ("Remaining Issues on Beam Management") (Sept./Oct. 2018) ("*Intel*")
Ex. 1007	U.S. Patent Application Publication No. US 2021/0050936 A1 to Seo et al. ("*Seo*")
Ex. 1008	Certified copy of U.S. Provisional Application No. 62/670,038 to Seo et al., filed May 11, 2018 ("*Seo Provisional*")
Ex. 1009	U.S. Patent Application Publication No. US 2019/0260445 A1 to Wilson et al. ("*Wilson445*")
Ex. 1010	U.S. Provisional Application No. 62/710,409 to Wilson et al., filed February 16, 2018 ("*Wilson445 Provisional*")

Exhibit	Description
Ex. 1011	3GPP TSG RAN WG1 Meeting #94 R1-1808197 ("Maintenance for Reference signals and QCL") (Aug. 2018) ("*ZTE*")
Ex. 1012	3GPP TS 38.214 v15.3.0 ("Technical Specification Group Radio Access Network; NR; Physical layer procedures for data (Release 15)") (Sept. 2018) ("*5G-Standard*")
Ex. 1013	U.S. Patent Application Publication No. US 2019/0229792 A1 to Wilson et al. ("*Wilson792*")
Ex. 1014	U.S. Provisional Application No. 62/621,536 to Wilson et al., filed January 24, 2018 ("*Wilson792 Provisional*")
Ex. 1015	3GPP TSG RAN WG1 Meeting #94b R1-1810366 ("Maintenance for beam management") (Sept./Oct. 2018) ("*Vivo366*")
Ex. 1016	3GPP TSG RAN WG1 Meeting #94 R1-1809758 ("Feature lead summary on QCL") (Aug. 2018) ("*Nokia*")
Ex. 1017	3GPP TSG RAN WG1 Meeting #94 R1-1808490 ("Remaining issues on downlink control channel") (Aug. 2018) ("*LG490*")
Ex. 1018	3GPP TS 38.211 v15.3.0 ("Technical Specification Group Radio Access Network; NR; Physical channels and modulation (Release 15)") (Sept. 2018) ("*TS-38.211*")
Ex. 1019	3GPP TS 38.213 v15.3.0 ("Technical Specification Group Radio Access Network; NR; Physical layer procedures for control (Release 15)") (Sept. 2018) ("*TS-38.213*")
Ex. 1020	3GPP TS 38.321 v15.3.0 ("Technical Specification Group Radio Access Network; NR; Medium Access Control (MAC) protocol specification (Release 15)") (Sept. 2018) ("*TS-38.321*")
Ex. 1021	3GPP TS 38.331 v15.3.0 ("Technical Specification Group Radio Access Network; NR; Radio Resource Control (RRC) protocol specification (Release 15)") (Sept. 2018) ("*TS-38.331*")
Ex. 1022	3GPP TSG RAN WG1 Meeting #94bis R1-1810369 ("Remaining issues on physical downlink control channel") (Sept./Oct. 2018) ("*Vivo369*")

Exhibit	Description
Ex. 1023	3GPP TSG RAN WG1 Meeting #94bis R1-1811634 ("Text proposals for Beam management") (Oct. 2018) ("*OPPO*")
Ex. 1024	3GPP TSG RAN WG1 Meeting #94 R1-1808330 ("Remaining issues on beam management and beam failure recovery") (Aug. 2018) ("*Sony*")
Ex. 1025	3GPP TSG RAN WG1 Meeting #94bis R1-1811820 ("Offline summary for PDCCH structure and search space") (Oct. 2018) ("*NTT*")
Ex. 1026	3GPP TSG RAN WG1 Meeting #94bis R1-1810256 ("Remaining issues on downlink control channel") (Sept./Oct. 2018) ("*LG256*")
Ex. 1027	3GPP TSG RAN WG1 Meeting #94bis R1-1810520 ("Open issues and corrections for NR PDCCH") (Sept./Oct. 2018) ("*CATT*")
Ex. 1029	Declaration of Friedhelm Rodermund
Ex. 1030	U.S. Provisional Application No. 62/754,165 to Cheng et al., filed November 1, 2018 ("the '896/'661 Provisional Application")
Ex. 1031	U.S. Patent No. 11,641,661 B2 to Cheng et al. ("the '661 patent")
Ex. 1032	File History for U.S. Patent No. 11,641,661
Ex. 1033	U.S. Patent Application Publication No. US 2020/0404690 A1 to Lee et al. ("*Lee*")
Ex. 1034	U.S. Provisional Application No. 62/652,827 to Lee et al., filed April 4, 2018 ("*Lee Provisional*")
Ex. 1035	3GPP TSG RAN WG1 Meeting #94 R1-1809864 ("Feature lead summary for beam management - Thursday") (Aug. 2018) ("*Ericsson*")
Ex. 1036	International Publication No. WO 2017/052199 A1 to You et al. ("*You*")

Exhibit	Description
Ex. 1037	U.S. Patent Application Publication No. US 2012/0122495 A1 to Weng et al. ("*Weng*")
Ex. 1038	U.S. Patent Application Publication No. US 2017/0094547 A1 to Yum et al. ("*Yum*")
Ex. 1039	International Publication No. WO 2017/171398 A1 to Yi et al. ("*Yi*")
Ex. 1040	Patent Owner's Complaint filed in *Hannibal IP*, *LLC v. Samsung Electronics Co.*, *Ltd.*, *et al.*, Case No. 4:25-cv-00200 (E.D. Tex.)

22. I have also relied on my education, experience, research, training, and knowledge in the relevant art, and my understanding of any applicable legal principles described in this declaration.

23. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my understanding of how a person of ordinary skill in the art would have understood the claims of the '896 patent at the time of the earliest claimed priority date.

24. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

V. LEGAL STANDARDS

25. I am not a lawyer. For purposes of this Declaration, I have been asked to provide my opinions on issues regarding unpatentability. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioners, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. In preparing this declaration, I have tried to faithfully apply these legal standards to the challenged claims.

26. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can "anticipate" a claim. Second, I have been informed that the prior art can render a claim "obvious" to a person of ordinary skill in the art. I understand that a claim is patentable if it was not anticipated and would not have been obvious by the prior art at the effective filing date of the patent.

27. I have been informed that a dependent claim is a patent claim that refers back to another patent claim. I have been informed that a dependent claim includes all of the limitations of the claim to which it refers.

28. I have been asked to provide my opinions as to whether the cited prior art teaches or renders obvious claims 1-19 of the '896 patent from the perspective

of a person of ordinary skill in the art at the '896 patent's earliest claimed priority date in 2018, as described in more detail below.

29. I have been informed that in *inter partes* review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means "more likely than not."

30. For purposes of this declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions.

A. Level of Ordinary Skill

31. I have been informed a person of ordinary skill in the art is determined by considering several factors, including the (i) type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) rapidity with which innovations are made; (iv) sophistication of the technology; and (v) educational level of active workers in the field.

32. I have been instructed to assume a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

B. Prior Art

33. I have been advised and understand the information used to evaluate whether an invention was new and not obvious when made is generally referred to as "prior art." I understand that prior art includes patents and printed publications that existed before the earliest claimed priority date or the earliest filing date of the patent (which I have been informed is also called the "effective filing date"). I have been informed and understand that a patent or published patent application is prior art if it was filed before the earliest filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the earliest filing date.

C. Anticipation

34. I have been informed that under 35 U.S.C. § 102, a patent claim is unpatentable for anticipation if the claimed subject matter was patented or described in a printed publication before the effective filing date of the claimed invention. I have been informed that this is referred to as unpatentability by anticipation. I have been informed that a patent claim is anticipated under § 102 if a single prior art reference discloses all limitations of the claimed invention.

D. Obviousness

35. I have been informed that obviousness under 35 U.S.C. § 103, a patent claim is unpatentable if the differences between the subject matter sought to be

patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which said subject matter pertains at the time the invention was made. I have been informed that this is referred to as unpatentability by obviousness.

36. I have been informed that a proper obviousness analysis includes the following:

a. Determining the scope and content of the prior art.
b. Ascertaining the differences between the prior art and the claims at issue.
c. Resolving the level of ordinary skill in the pertinent art.
d. Considering evidence of secondary indicia of non-obviousness (if available).

37. I have been informed that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention. For my obviousness analysis, counsel for Petitioners instructed me to assume that the date of invention for the Challenged Claims is November 1, 2018. My opinions would not change if I assumed a later date of invention.

38. I have been informed that a reference may be modified or combined with other references or with a person of ordinary skill in the art's own knowledge if the person would have found the modification or combination obvious. I have

also been informed that a person of ordinary skill in the art is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a person of ordinary skill in the art would employ.

39. I have been informed that whether a prior art reference renders a patent claim obvious is determined from the perspective of a person of ordinary skill in the art. I have also been informed that, while there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a person of ordinary skill in the art would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

40. In determining whether a prior art reference could have been combined with another prior art reference or other information known to a person having ordinary skill in the art, I have been informed that the following principles may be considered:

a. A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results.

b. The substitution of one known element for another is likely to be obvious if it yields predictable results.

c. The use of a known technique to improve similar items or methods in the same way is likely to be obvious if it yields predictable results.

d. The application of a known technique to a prior art reference that is ready for improvement to yield predictable results.

e. Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed.

f. A person of ordinary skill often will be able to fit the teachings of multiple references together like a puzzle.

g. The proper analysis of obviousness requires a determination of whether a person of ordinary skill in the art would have a "reasonable expectation of success"—but not "absolute predictability" of success—in achieving the claimed invention by combining prior art references.

41. I have been informed that, when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the

same field or in another. I have been informed that if a person of ordinary skill in the art could have implemented a predictable variation and would have seen the benefit of doing so, that variation is likely to have been obvious. I have been informed that, in many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. I have been informed that, when there was a design need or market pressure and there are a finite number of predictable solutions, a person of ordinary skill in the art would have had a good reason to pursue those known options.

42. I have been informed that the law permits the application of "common sense" in examining whether a claimed invention would have been obvious to a person skilled in the art. For example, I have been informed that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. I understand, however, that a claim is not obvious merely because every claim element is disclosed in the prior art and that a party asserting obviousness must still provide a specific motivation to combine or modify the references as recited in the claims and explain why one skilled in the art would have reasonably expected to succeed in doing so.

43. I have been informed that there is no rigid rule that a reference or combination of references must contain a "teaching, suggestion, or motivation" to combine references. But I also understand that the "teaching, suggestion, or motivation" test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been informed that this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

44. I am not aware of any evidence of secondary considerations that would support a determination of non-obviousness of the claimed subject matter in the '896 patent.

45. I have been informed that, in an obviousness analysis, prior art must be analogous prior art to the patent being considered. I have been informed that a prior art reference is considered to be analogous, or in the same field of art, if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

VI. TECHNOLOGY BACKGROUND AND STATE OF THE PRIOR ART

46. For this Declaration, I have assumed that the priority date of the challenged claims is November 1, 2018, as this is the earliest possible priority date. Thus, for purposes of this analysis, I assume that the time of the purported invention of the ’896 patent was November 1, 2018, and have provided an overview of the background of the relevant technology at that time.

A. Field of Technology

47. As is explained in the “FIELD” section of the ’896 patent, the relevant field of technology is “wireless communication” in general and, more particularly, “determining Quasi Co-Location (QCL) assumptions for beam operations.” Ex 1001, 1:17-20. In the “BACKGROUND” section, the ’896 patent explains that “a User Equipment (UE) may perform beam operations to switch its beam(s) to transmit or receive channels or resources.” Ex. 1001, 1:27-29.

B. Third Generation Partnership Project (3GPP)

48. “Wireless communications” necessarily implies that information is transmitted without the use of “wires.” This is accomplished by transmitting electromagnetic waves from some point of origin A with the intent that the electromagnetic waves will be successfully received at some intended destination point B.

49. The "Advanced Mobile Phone System" ("AMPS") was the first nationwide wireless communications system standardized in the USA and was released in the 1980s and was an analog, as opposed to digital, system. AMPS is sometimes referred to as a first generation or "1G" cellular communication technology. A subsequent short-lived system, referred to as IS-54, was developed and then quickly replaced by a better system referred to as IS-136 in the early 1990s. IS-54 and IS-136 are now commonly referred to as second generation or "2G" technologies. Around the same time that these 2G systems were released, Qualcomm began developing a different system to replace AMPS in direct competition with IS-54/IS-136. This new system was standardized in what is called the "IS-95 standard," or simply just "IS-95." IS-95 was the first ever code division multiple access ("CDMA") based digital cellular technology. CDMA allows multiple access to digital radio signals for transmission of voice, data, and signaling data. IS-95 was first published in 1995 and adopted as a wireless communications standard in the USA by the Telecommunications Industry Association.

50. Around this same time period that the IS-95 was being developed in the US, the European Telecommunications Standard Institute ("ETSI") developed the Global System for Mobile Communications ("GSM") technical specifications. Unlike IS-95, GSM is based on a time division multiple access ("TDMA")

technology. Similar to IS-54 and IS-136, IS-95 and GSM are also commonly referred to as “2G” technologies because they were the first viable cellular systems to use digital transmission techniques, as opposed to the analog techniques used in AMPS.

51. GSM continued to evolve with the development of GPRS (which stands for General Packet Radio Service) and EDGE (which stands for Enhanced Data rates for GSM Evolution). GPRS and/or EDGE have sometimes been referred to as “2.5G” systems, even though there is no general agreement as to what exactly “2.5G” does or does not include. Over time, GSM developed greater market share globally than its IS-95 CDMA-based competitor. In the late 1990s, IS-95 showed that an air interface based on CDMA was viable. GSM had developed the necessary superior networking protocols. The industry then converged by merging the best aspects of the TDMA GSM system with the best aspects of the CDMA IS-95 system to create an improved worldwide system. As part of that effort, a new organization was formed in 1998 called the “3rd Generation Partnership Project,” or “3GPP.” The 3GPP was tasked with developing new wireless communication specifications for this system, which was referred to as a “3rd Generation” or “3G” specification.

52. 3GPP is a global joint undertaking by national and regional telecommunication standards organizations and member companies focused on

defining interoperable telecommunications networks and user equipment. 3GPP was tasked with an initial objective to produce technical specifications for a third generation ("3G") cellular communication system, called the Universal Mobile Telecommunications Service ("UMTS"). UMTS is a 3G mobile cellular system for networks based on the second generation (2G) GSM standard in conjunction with the best CDMA aspects of the IS-95 air interface, as I mentioned above.

53. While 3GPP is not formally a standards-setting organization, it operates as one from a practical perspective. 3GPP develops technical specifications that are then typically adopted by the respective standards-setting bodies of a given country or region. At the core of 3GPP's organization are seven "Organizational Partners," each of which is a standards-setting organization in a different country or region:

- Association of Radio Industries and Businesses, or ARIB (Japan);
- Telecommunication Technology Committee, or TTC (Japan);
- Alliance for Telecommunications Industry Solutions, or ATIS (US);
- China Communications Standards Association, or CCSA (China);
- The European Telecommunications Standards Institute, or ETSI (Europe);

- Telecommunications Standards Development Society, or TSDSI (India); and
- Telecommunications Technology Association, or TTA (Korea).

See, *e.g.*, "About 3GPP," *available at* https://www.3gpp.org/about-us/partners.

54. 3GPP employs a model similar to one that had been used earlier by ETSI, which had developed GSM. This includes a hierarchical structure in which Working Groups ("WGs") are the source of technical contributions, some of which ultimately mature into Technical Specifications. In addition, several WGs are part of a given Technical Specification Group, or TSG. There are several Technical Specification Groups, each one having a number of WGs and covering technical subject matter that is defined and follows a logical, hierarchical structure. In the 2018 time period, the three active 3GPP TSGs were the Radio Access Network ("RAN"), Service and System Aspects ("SA"), and Core Network and Terminals ("CT") TSGs.

55. The RAN TSG is the TSG responsible for the standards and proposals relevant to '896 patent. The RAN TSG consists of several Working Groups, referred to, for example, as RAN1 and RAN2 or RAN WG1 and RAN WG2. Each WG holds periodic meetings in which technical documents (or "TDocs") are presented and discussed for possible inclusion in the Technical Specifications ("TS"), which are sometimes also referred to as Technical Standards. These

meetings are numbered and referred to as, for example, TSG-RAN WG1 Meeting #94, which would thus refer to Meeting #94 of Working Group 1 of the RAN TSG. At these meetings, different proposals are discussed, their pros and cons considered, and ultimately some of them, or some hybrid of one or more of them, may get approved and included in the TS.

56. In the late 1990s, 3GPP successfully developed UMTS, which enjoyed worldwide success. A few years later, around 2004, 3GPP initiated the "Long Term Evolution", or "LTE," project, which is also referred to as "4G." Around 2017, 3GPP began work on what has come to be known as "New Radio," or "NR," and also referred to as "5G." As mentioned above, the '896 patent refers to NR and 5G as being developed by 3GPP. Ex. 1001, 1:24-40, 8:3-6. 3GPP is thus sometimes referred to as the standard-setting body of the 5G Standard.

57. The NR project had several goals for a 5G cellular standard, including increased data rates, improved quality of service, and decreased complexity. 3GPP released the first "5G" Technical Specifications (TS) in late 2017 or early 2018, in what was called "Release 15." This release (and later releases such as 16, 17, and 18) were generally referred to as the "5G Standard." Thus, the 5G Standard was constantly evolving over time. And the 5G Standard is not just a single document. Rather, it includes a collection of technical specifications pertaining to different aspects of the 5G system. For example, in this declaration, I have cited to 3GPP

TS 38.214 v15.3.0 (Ex. 1012) and 3GPP TS 38.331 v15.3.0 (Ex. 1021). They are both part of the 5G Standard, but pertain to physical layer and Radio Resource Control (RRC) layer, respectively. Moreover, "v15.3.0" in the names of these two technical specifications indicate they are version 15.3.0, released in September 2018. There are earlier and later versions released before or after this date. As the 5G Standard evolves over time, the 5G systems complying with the 5G Standard would also evolve over time.

C. 5th Generation (5G) Telecommunication

58. As the '896 patent acknowledges, the alleged invention was aimed at the "next generation (e.g., Fifth Generation (5G) New Radio (NR))" of wireless telecommunication systems. Ex. 1001, 1:24-27. The development of 5G was a collaborative effort involving hundreds of engineers from many companies. These efforts often focused on a user equipment's (UE) speed and efficiency when handling "downlink" communications from the base station (BS) to the UE.

59. The '896 patent describes and claims several fundamental aspects of a 5G system. These include: (a) Beams, (b) Bandwidth Parts (BWPs), (c) Control Resource Sets (CORESETs), (d) Quasi Co-Location (QCL) assumptions, and (e) other aspects like Physical Downlink Control Channel (PDCCH), Downlink Control Information (DCI), aperiodic Channel State Information-Reference Signals (CSI-RS), and Physical Downlink Shared Channel (PDSCH). While presented in a

complex manner in the '896 patent's claims, these were fundamental aspects of 5G well known before the patent's filing.

60. Because the '896 patent focuses on a UE's downlink functionality, the below background generally describes these known 5G terms, along with the role each has in a downlink. Figures 1 and 2 below further illustrate these 5G terms. As explained further in the sections below, Fig. 1 concerns a more-typical situation where a "scheduling offset" is greater than a threshold, while Fig. 2 concerns a less-typical situation where the "scheduling offset" is less than the threshold.

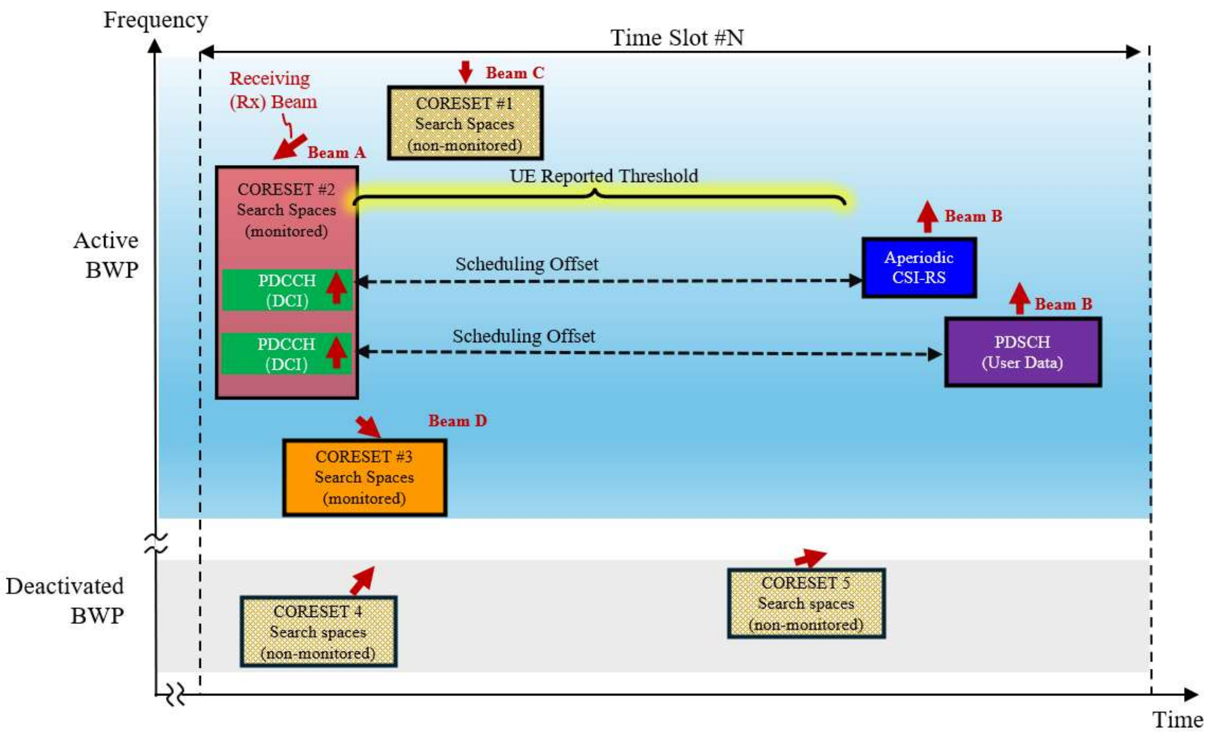

Fig. 1

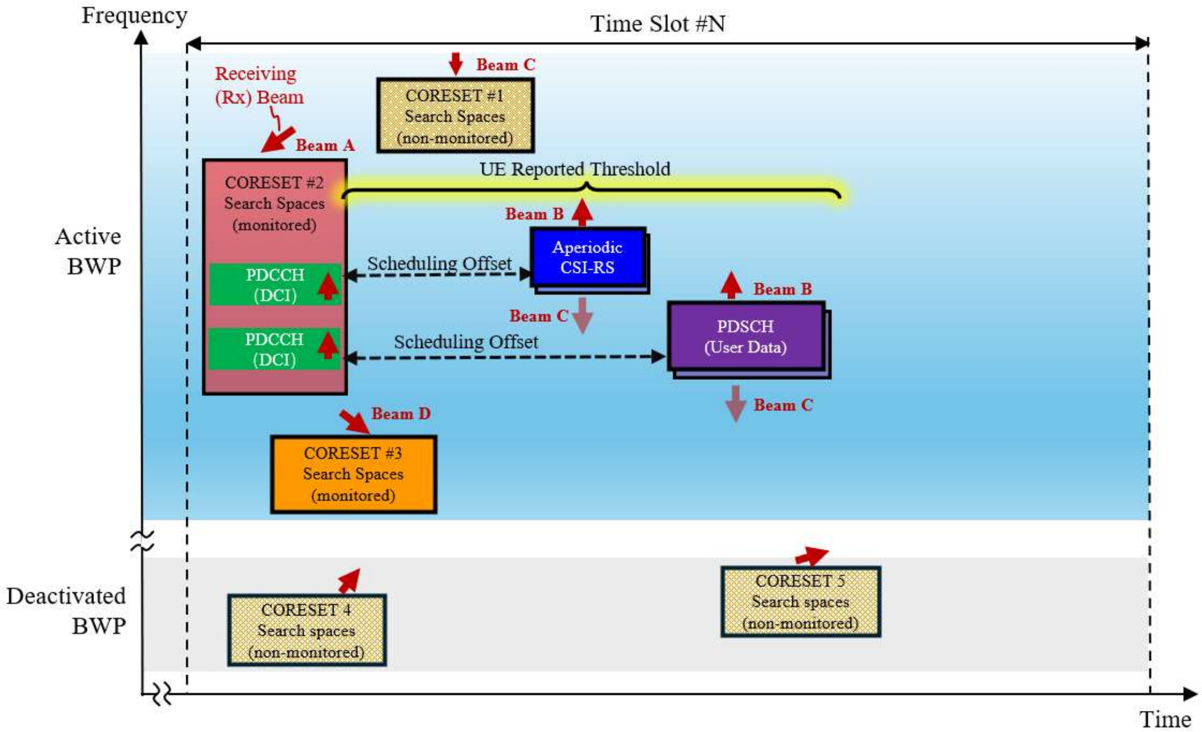

Fig. 2

D. A UE's Known Downlink Operation in 5G

61. 5G was known to provide substantially faster speeds, lower latency, and increased capacity, while increasing its flexibility. The following section references the above figures and describes a typical 5G downlink.

1. Beams

62. Generally, each BS uses beams to communicate with the UEs in that BS's serving cell. *See*, *e.g.*, *Guo* (Ex. 1005), [0104], [0114]-[0122], FIGS. 10-11. For example, as shown below, "[a]fter the UE 1111 is associated with the serving cell 1112, the UE 1111 is further associated with beam 1151." *Guo*, [0114]. "This is achieved by acquiring a beam or radio resource (RR) acquisition signal from which the UE can acquire a beam identity or identification." *Guo*, [0114]. "An

example of beam or RR acquisition signal is a measurement reference signal (RS)." *Guo*, [0114].

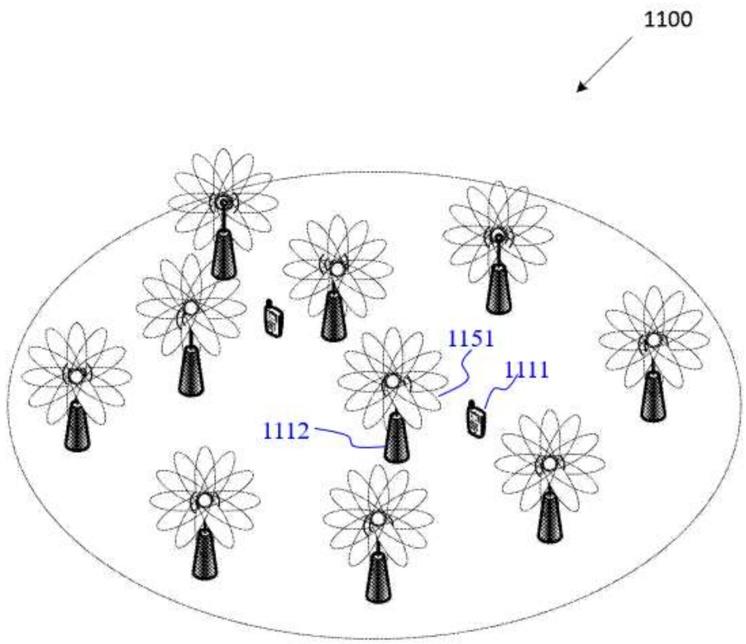

FIG. 11

Guo, FIG. 11.

63. Typically, a UE receives multiple beams from each BS. *Guo*, [0114], FIG. 11. Because the beams received by a UE have varying signal reliability (e.g., due to interference, the UE's location, the UE's velocity, etc.), the 5G Standard defined how the UE may select which beam(s) to use, as well as how to use a CORESET on one beam (e.g., for scheduling the receipt of a PDSCH) and "switch" to another beam for receiving the scheduled PDSCH. *See*, *e.g.*, *5G-*

Standard (Ex. 1012), 26-28. For example, Fig. 1 and 2 show CORESETs #1 - #5, each on a different beam (e.g., beams C, A, and D for CORESETs #1, #2, and #3, respectively).

2. Bandwidth Parts (BWPs) and Time Slots

64. 5G divides its frequency spectrum into BWPs. *See*, *e.g.*, *Guo*, [0135]-[0137]. Each UE can have up to four BWPs, each BWP defining a different bandwidth and other differences.[1] 5G also uses "time slot" as a measurement unit

[1] Only one BWP is "active" at any given time. 3GPP TS 38.211 v15.3.0 ("*TS-38.211*"; Ex. 1018), § 4.4.5 ("A UE can be configured with up to four bandwidth parts in the downlink with a single downlink bandwidth part being active at a given time."). Typically, a UE can receive and monitor data (e.g., CORESETs, PDSCHs, etc.) within only the active BWP. Also, because each BWP has a different configuration, this enables 5G to offer increased flexibility, as a different BWP can become "active" for the UE. For example, if a UE demands more data, then the UE can activate a BWP with a wider bandwidth. The above Figures 1 and 2 also illustrate CORESETs received in the "active" BWP and those received in a "deactivated" BWP.

in the time domain.[2] And within the active BWP,[3] a UE may receive one or more beams during any one time slot. The physical resources allocated to a UE's BWP can thus be visualized via a grid in which the x-axis is the time domain (containing one or more time slots) and the y-axis is the frequency domain (containing the subcarriers of each available BWP).

65. For a downlink, an activated BWP specifies where in the frequency bandwidth a UE looks for data from a BS. Because the UE is allocated only one active BWP during any one time slot, the BS will then transmit data to that UE in that time slot(s) and by using the carrier frequency(ies) for that active BWP.

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[2] 5G also uses other lengths (e.g., frames and subframes) not described here.

[3] Only one BWP is "active" at any given time for each UE. Typically, a UE can receive and monitor data (e.g., CORESETs, PDSCHs, etc.) within only the active BWP. Also, because each BWP has a different configuration, this enables 5G to offer increased flexibility by allowing a different BWP to become "active." For example, if a UE demands more data, then the UE can activate a BWP with a wider bandwidth. The above figures illustrate CORESETs transmitted in the "active" BWP and those transmitted in a "deactivated" BWP.

3. Control Resource Sets (CORESETs)

66. In 5G, a BS transmits within a BWP a PDCCH in various CORESETs on respective beams to each UE. Figs. 1 and 2 show five CORESETs transmitted to the UE, where a PDCCH in each CORESET is transmitted on a particular beam. The BS configures these CORESETs at a scheduled time within a time slot but usually at the slot's beginning. The UE can monitor up to 3 CORESETs within the currently active BWP. As shown, the BS can configure other CORESETs in the deactivated BWP(s) for the UE, but the UE will not monitor those. The UE may also not monitor other CORESETs within the active BWP (e.g., because the UE has not configured itself to do so). For example, Figs. 1 and 2 show the UE does not monitor CORESET #1 in the active BWP and does not monitor CORESETs #4 and #5 in a deactivated BWP.

67. Each CORESET has an associated time range (within a time slot) and an associated frequency range (within a BWP). And because the UE can receive multiple overlapping CORESETs during one time slot of the active BWP, each CORESET has a unique identifier (e.g., the CORESET ID). Figs. 1 and 2 use #1 - #5 to signify such CORESET IDs. The BS will separately inform the UE of the IDs of all CORESETs configured for the UE in at least the currently active BWP.

68. Each CORESET may contain, within its search spaces, control information that the UE will use during an associated downlink. A search space

may include a PDCCH containing the DCI. The UE uses this PDCCH to schedule receiving the aperiodic CSI-RS or receiving the PDSCH (i.e., the payload data). The PDCCH thus functions as a control channel for transmitting schedule information, and the PDSCH functions as a data channel for transmitting messages. More specifically, the DCI contains the instructions that tell the UE when (in the time domain) and where (in the frequency domain) to receive and decode the PDSCH payload data (e.g., web or video content). *Weng* (Ex. 1037), [0226]; *You* (Ex. 1036), [104].

69. In 5G, the UE typically does not know which PDCCH it receives contains a DCI intended for that UE. This is because the DCI may be for a different UE. The UE thus has to "search" through all the "search spaces" of the CORESET by decoding each PDCCH to determine if the decoded information contains a DCI for that UE. *You*, [117]; *Yum* (Ex. 1038), [0061]. If the UE does decode a DCI for that UE, then the UE will configure itself to receive the associated PDSCH. This process requires a UE to blindly monitor the CORESETs. While this blind decoding has a complexity cost, it increases flexibility since scheduling the PDCCH's receipt is not needed.

70. However, CORESETs configured for a UE may be "monitored" or "non-monitored." A "monitored" CORESET is one where the UE has been configured to search through the search spaces of that CORESET to determine if

they include any DCI for that UE. The UE does this at designated "monitoring occasions." Other CORESETs are simply "not monitored" by the UE.

71. At a more granular level, the smallest element within a CORESET is called a Resource Element ("RE"). Each RE corresponds to one symbol within the time domain. Thus, for example, a PDCCH within a search space may be composed of symbols.

72. Finally, as indicated above, a CORESET may also contain a DCI for receiving an aperiodic CSI-RS from the BS. Per the 5G Standard, the UE may use this CSI-RS to estimate channel quality, e.g., to track signal quality and monitor reception conditions. *5G-Standard*, 42 ("If a UE is not configured with higher layer parameter *timeRestrictionForChannelMeasurements*, the UE shall derive the channel measurements for computing CSI value reported in uplink slot n based on only the NZP CSI-RS …").

E. Known "Beam Switching" in 5G

73. As discussed, it was already known to use different beams in a downlink. Thus, the flexibility in 5G was already understood to allow for the use of multiple beams when scheduling the receipt of the CSI-RS or PDSCH. *Guo*, [0113]-[0119], [0124], [0189]-[0190]; *Yi* (Ex. 1039), [71], [175].

74. For example, a BS can configure multiple CORESETs that overlap at the UE in the time domain during a single cell operation. If the UE monitors each

of these CORESETs (e.g., the UE decodes the search spaces within these CORESETs to determine which contain the PDCCH for that UE), then the UE may detect a PDCCH for that UE and use that PDCCH to schedule receiving the associated CSI-RS or PDSCH.

75. For example, in Figs. 1 and 2 above, the UE can blindly decode CORESETs #2 and #3 but detect that CORESET #2 contains, for the UE, a PDCCH with DCI for scheduling receipt of the aperiodic CSI-RS and another PDCCH with DCI for scheduling receipt of the PDSCH.

76. Under the 5G Standard in 2018, if more than one monitored CORESET contained the PDCCH for the UE, then that UE could choose to use, e.g., for receiving the PDSCH, the information of the CORESET having the lowest ID. The UE could then switch to a new beam (e.g., for receiving the PDSCH) based on a threshold offset and other priority rules. *5G-Standard*, 26-27.

77. For example, in Fig. 1 above, CORESET #2 is received with a beam direction that points to the down-left (e.g., beam A), while the DCI carried by CORESET #2 indicates that the receiving beam direction of the PDSCH points to directly upward (e.g., beam B) (see red arrows). If the "scheduling offset" is larger than the associated UE threshold, then the UE could switch from beam A to beam B without difficulty. But as shown in Fig. 2, if the "scheduling offset" is below the threshold, then the relevant 5G Standard instructed using the QCL of CORESET

#1 (i.e., the CORESET with the lowest ID amongst all monitored and non-monitored CORESETs), and thus beam C with the direction that points directly downward. Thus, in the Fig. 2 scenario, the UE would apply the QCL of CORESET #1 to receive either the CSI-RS or the PDCCH on beam C.

F. Known "Quasi Co-Location (QCL)" Assumptions in 5G

78. A 5G system can assume some beams transmitted to the UE are reasonably close to one another in terms of reliability. When the beams are determined to have a high degree of similarity, the UE can interchange these beams without much degradation in performance. The UE can thus "assume" any of these beams can deliver data with sufficient reliability and that they each locate the UE in the wireless channel with reasonable accuracy. This is called a "quasi co-location" (QCL) assumption.

79. In 5G, a CORESET contains a Transmission Configuration Indication (TCI) defining a state indicating a QCL assumption (e.g., with respect to a PDCCH and a CSI-RS or a PDSCH).[4] The UE can use the QCL assumptions to compare the beams (e.g., a beam including a PDCCH and a beam including a PDSCH).

[4] The QCL included within the TCI can get more detailed beyond the scope of this Petition. For example, the QCL can consist of different types, can define different property similarities, can define relationships with respect to DM-RS ports, etc.

80. To further explain, each combination of measurements can be used to determine which beams are similar. The UE may then assume that certain beams are similar for a particular UE's downlink operation. For example, consistent with the 5G Standard, Fig. 2 above shows a scenario where the UE would assume that beams B and C were similar based on the QCL assumption of CORESET #1.

81. In general, a QCL assumption can thus be used to determine that a beam associated with a CORESET is a potential substitute for the beam used to receive subsequent information (e.g., CSI-RS or PDSCH). So, if the BS transmits multiple CORESETs using beams deemed interchangeable due to their QCL assumption, the relevant 5G Standard stated that the UE can receive subsequent transmissions from the BS using an alternative beam deemed interchangeable within a designated time window. *See*, *e.g.*, Ex. 1018, *TS-38.211*, 11 ("Two antenna ports are said to be quasi co-located if the large-scale properties of the channel over which a symbol on one antenna port is conveyed can be inferred from the channel over which a symbol on the other antenna port is conveyed."). For example, in Fig. 2 above (which concerns a scenario where the scheduling offset is below the threshold), if the UE determines based on the QCL assumptions that beam C (of CORESET #1) and beam B (transmitting the PDSCH) are interchangeable, then the UE can use the CORESET of beam C to schedule receipt

of a PDSCH of beam B—again, when the "scheduling offset" between the DCI of CORESET #2 and the PDSCH is less than a threshold.

82. The 5G Standard instructed that the QCL assumption is included in the part of the DCI that schedules a CSI-RS or PDSCH transmission. Specifically, the QCL assumption is in the TCI field of the DCI. *5G-Standard*, 26 ("If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled' for the CORESET scheduling the PDSCH, the UE assumes that the TCI field is present in the DCI format 1_1 of the PDCCH transmitted on the CORESET."); *Guo*, [0189] ("The N-bit TCI field in that DCI used to indicate spatial QCL configuration for the scheduled PDSCH can be used to indicate the spatial QCL configuration for the triggered transmission of CSI-RS resources by the same DCI.").

VII. THE '896 PATENT

A. Alleged Invention of the '896 Patent

83. The '896 patent discusses several optional changes to the 5G Standard existing in 2018. But its claims relate to the subsection of the '896 patent entitled "Non-Monitored CORESET for a Default Aperiodic CSI-RS Beam," which is discussed with respect to FIG. 3. Ex. 1001, 13:1-45, FIG. 3. This embodiment concerns the downlink signaling from the BS to the UE. Ex. 1001, 13:1-45, FIG. 3.

84. The ’896 patent addresses the downlink procedure that a UE performs when processing multiple CORESETs in a 5G system. Ex. 1001, 1:41-44, 1:66-2:20. The ’896 patent’s specification begins with the alleged “ambiguity” in the then-existing 5G specifications that caused concerns with “beam switching.” Ex. 1001, 1:32-40.

85. To address this known problem of “beam switching,” the ’896 patent describes using the relevant 5G Standard’s QCL assumptions for received beams. Ex. 1001, 1:17-20, 1:41-44. As the ’896 patent acknowledges, a UE, in 5G, monitors at least one CORESET in the active BWP in a time slot. Ex. 1001, 17:16-18, FIG. 9 (step 902). The UE may also receive a non-monitored CORESET—perhaps one with the lowest CORESET ID in the active BWP. Ex. 1001, 13:19-40. The relevant 5G Standard allowed for such a non-monitored CORESET to be used to schedule the receipt of a CSI-RS if the “scheduling offset” was small enough. Ex. 1001, 13:32-41.

86. To reduce the potential for “beam switching” to a non-monitored CORESET when scheduling the receipt of a CSI-RS or PDSCH, the ’896 patent proposes using the CORESET with the lowest CORESET ID of all the “monitored” CORESETs, rather than amongst all (monitored and un-monitored) CORESETs. Ex. 1001, 13:32-45. The ’896 patent also explains that the above can be readily applied to “scheduling a PDSCH from a PDCCH” when a small enough

"scheduling offset" occurs. Ex. 1001, 17:23-36. The '896 patent describes that this is the same "scheduling offset" used in the 5G Standard, namely, an offset between an end of the PDCCH and a beginning of the PDSCH. Ex. 1001, 17:23-36.

87. Claim 1 of the '896 patent recites:

> **[1Preamble]** A user equipment (UE) comprising:
>
> **[1a]** one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
>
> **[1b]** at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:
>
> **[1c]** monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and
>
> **[1d]** apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more *monitored* CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),
>
> **[1e]** wherein the first CORESET is associated with a *monitored* search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs.

Ex. 1001, 19:4-22 (emphases added).

88. According to the ’896 patent, only the “monitored” limitation in claim 1 corresponds to the ’896 patent’s alleged contribution to the art, as I explain above. Ex. 1001, 13:1-23. In other words, the alleged solution of the ’896 patent is to limit the lowest CORESET ID used for determining the QCL assumption to only “monitored” CORESETs.

B. Prosecution History

89. The application that matured into the ’896 patent was filed on October 22, 2019, as U.S. Patent Application No. 16/660,726 and claims priority to U.S. Provisional Application No. 62/754,165, filed November 1, 2018. Ex. 1001, cover; Ex. 1002, 3, 44.

90. During prosecution, the Examiner issued a first-action allowance. Ex. 1002, 176-185. In the Notice of Allowance, the Examiner discussed the prior art of record. Ex. 1002, 182-183. But none of the prior art discussed in the prior art section below, namely, *Guo*, *Intel*, *ZTE*, and *5G-Standard*, were considered during prosecution.

VIII. CLAIM CONSTRUCTION

91. I have been instructed that the “intrinsic record” includes the patent itself, including the claims, description, and figures (Ex. 1001), and the patent’s prosecution history—i.e., the record of proceedings at the U.S. Patent and Trademark Office (“Patent Office”) concerning the patent (Ex. 1002). I understand

that, like the claims and written description, the prosecution history provides evidence to a person of ordinary skill in the art of how the inventor intended his patent to be understood, and how the Patent Office understood the patent. I understand that the inventor is permitted to apply a special definition to the terms or to limit the scope of claim terms in his patent claims, which may differ from the term's plain and ordinary meaning. That special definition or limitation on scope may be provided in the patent's written description, the patent's prosecution history, or both.

92. I understand that claim interpretation may also be informed by "extrinsic evidence" (that is, evidence outside of the patent record itself). I have been informed that extrinsic evidence may include dictionaries, technical treatises, and other materials evidencing the meaning of a claim term and the understanding held by a POSITA in the relevant time period.

93. I have been asked for purposes of this declaration to apply the plain and ordinary meaning of the claim terms as they would have been understood by a person of ordinary skill in the art at the earliest claimed priority date of the '896 patent.

94. I understand that no claim term's construction is in dispute at this time. Based on my review of these materials and my personal knowledge and experience, I have considered each term of the '896 patent as it would have been

understood by a person of ordinary skill in the art at the earliest claimed priority date of November 1, 2018.

IX. LEVEL OF ORDINARY SKILL IN THE ART

95. In rendering the opinions set forth in this declaration, I have been asked to consider the '896 patent's claims and the prior art through the eyes of a person of ordinary skill in the art (which I may also refer to as "one skilled in the art," "skilled artisan," "POSITA," or similar variation). I have considered factors such as the educational level and years of experience of those working in the pertinent art, the types of problems encountered in the art, the teachings of the prior art, patents and publications of other persons or companies, and the sophistication of the technology.

96. Taking the factors described in the Legal Standards—Level of Ordinary Skill section into consideration, it is my opinion that a person of ordinary skill in the art ("POSITA") at least a master's degree in electrical engineering or a similar field and at least five years of experience working with wireless mobile telecommunications systems. In my opinion, additional relevant work experience can compensate for less education, and *vice versa*.

X. THE PRIOR ART

97. In forming my opinions, I found the following prior art relevant when considering whether the claims of the '896 patent would have been obvious to a person of ordinary skill in the art.

Ex. 1005	U.S. Patent Application Publication No. US 2018/0343653 A1 to Guo ("*Guo*")
Ex. 1006	3GPP TSG RAN WG1 Meeting #94bis R1-1810751 ("Remaining Issues on Beam Management") (Sept./Oct. 2018) ("*Intel*")
Ex. 1011	3GPP TSG RAN WG1 Meeting #94 R1-1808197 ("Maintenance for Reference signals and QCL") (Aug. 2018) ("*ZTE*")
Ex. 1012	3GPP TS 38.214 v15.3.0 ("Technical Specification Group Radio Access Network; NR; Physical layer procedures for data (Release 15)") (Sept. 2018) ("*5G-Standard*")

A. US 2018/0343653 ("*Guo*")

98. U.S. Patent Application Publication No.2018/0343653 ("*Guo*"; Ex. 1005) was filed May 17, 2018, and published November 29, 2018. *Guo*, cover page, (22), (43). Throughout this declaration, I will refer to it as "*Guo*." I have been informed that *Guo* is prior art to the '896 patent.

99. Based on my understanding of analogous art, it is my opinion that *Guo* is analogous art to the '896 patent because it is directed to the same field of endeavor—5G wireless communications, including using QCL assumptions for beam operations. *Guo*, title, [0044]-[0048], [0052]-[0053], [0098]-[0099], [0121]-[0214]; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. *Guo* also concerns the same problem/solution that the '896 patent alleges: reducing unfavorable "beam switching" by using a CORESET's QCL to receive subsequent signals, such as a DL RS (e.g., aperiodic CSI-RS) or a PDSCH. *Guo*, [0125], [0134]-[0136], [0190]; Ex. 1001, Abstract, 13:1-45.

B. R1-1810751 ("*Intel*")

100. 3GPP TSG-RAN WG1 Meeting #94b R1-1810751, titled "Remaining Issues on Beam Management" and submitted by Intel Corporation ("*Intel*"; Ex. 1006). Throughout this declaration, I will refer to it as "*Intel*." I understand that *Intel* was made publicly available not later than September 29, 2018, on 3GPP's ftp server where it was accessible and known to be found by POSITAs. Ex. 1029, Rodermund Declaration, ¶¶25, 109-117. I also understand that *Intel* was made available and discussed at the 3GPP WG1 #94b meeting October 8-12, 2018, where it was publicly available to and discussed by POSITAs. Ex. 1029, Rodermund Declaration, ¶¶110, 115-116. I have been instructed that this makes *Intel* prior art to the '896 patent.

101. Based on my understanding of analogous art, it is my opinion that *Intel* is analogous art to the ’896 patent because it is directed to the same field of endeavor—5G wireless communications, including using QCL assumptions for beam operations. *Intel*, 1-15; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. In fact, *Intel* was a proposed improvement to the then-existing 5G Standard itself. And *Intel* offered the same solution as the ’896 patent: using a CORESET’s QCL assumption to receive a PDSCH or CSI-RS. *Intel*, 1-4, 11-12; Ex. 1001, Abstract, 13:1-45.

C. R1-1808197 (“*ZTE*”)

102. 3GPP TSG-RAN WG1 Meeting #94 R1-1808197, titled “Maintenance for Reference signals and QCL” and submitted by ZTE Corporation (“*ZTE*”; Ex. 1011). Throughout this declaration, I will refer to it as “*ZTE*.” I understand that *ZTE* was made publicly available not later than August 11, 2018, on 3GPP’s ftp server where it was accessible and known to be found by POSITAs. Ex. 1029, Rodermund Declaration, ¶¶20, 63-71. I also understand that *ZTE* was made available and discussed at the 3GPP WG1 #94 meeting August 20-24, 2018, where it was publicly available to and discussed by POSITAs. Ex. 1029, Rodermund Declaration, ¶¶64, 69-70. I have been instructed that this makes *ZTE* prior art to the ’896 patent.

103. Based on my understanding of analogous art, it is my opinion that *ZTE* is analogous art to the ’896 patent because it is directed to the same field of endeavor—5G wireless communications, including using QCL assumptions for beam operations. *ZTE*, 11-14; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. Indeed, *ZTE* is another reference directed to the same solution as the ’896 patent: reducing unfavorable “beam switching” by using a CORESET’s QCL assumption to receive subsequent data, such as PDSCH. *ZTE*, 11-14; Ex. 1001, Abstract, 13:1-45.

D. 3GPP TS 38.214 v15.3.0 (“*5G-Standard*”)

104. 3GPP TS 38.214 v15.3.0 (2018-09), titled “Technical Specification Group Radio Access Network; NR; Physical layer procedures for data (Release 15)” (“*5G-Standard*”; Ex. 1012). It is part of the 3GPP technical specifications that were commonly understood and collectively referred to as the “5G Standard” existing at the time of the alleged invention of the ’896 patent and at the time of the *Intel* and *ZTE* proposals. Throughout this declaration, I will refer to 3GPP TS 38.214 v15.3.0 as “*5G-Standard*.”[5] I understand that *5G-Standard* was made

[5] Again, TS 38.214 v15.3.0 is just one of the 3GPP technical specifications that collectively formed the 5G standard existing before the time of the ’896 patent. Solely for the purpose of simplicity, in the following discussion I will use

publicly available not later than October 1, 2018, on 3GPP's ftp server where it was accessible and known to be found by POSITAs. Ex. 1029, Rodermund Declaration, ¶¶31, 165-173. I have been instructed that this makes *5G-Standard* prior art to the '896 patent.

105. Based on my understanding of analogous art, it is my opinion that *5G-Standard* is analogous art to the '896 patent because it is directed to the same field of endeavor—5G wireless communications as well as determining QCL assumptions for beam operations. *5G-Standard*, 8-72; Ex. 1001, 1:17-20, 1:48-2:30, 4:19-5:2, 13:1-45. *5G-Standard* concerned the use of a QCL assumption of a CORESET to receive a data signal, such as PDSCH or CSI-RS. *5G-Standard*, 26-35, 39-41; Ex. 1001, Abstract, 13:1-45.

"*5G-Standard*" (in italics) to refer to TS 38.214 v15.3.0 only. However, throughout the declaration, I will also use "5G Standard" (in non-italicized text) to refer to the collection of all the 3GPP technical specifications deemed by POSITAs as the 5G standard before the time of the '896 patent, which not only includes the TS 38.214 v15.3.0, but also includes other 3GPP "Release 15" technical specifications, such as TS 38.211 v15.3.0 (Ex. 1018), TS 38.213 v15.3.0 (Ex. 1019), TS 38.321 v15.3.0 (Ex. 1020), TS 38.331 v15.3.0 (Ex. 1021), etc.

XI. GROUNDS OF UNPATENTABILITY

106. Based on my review of the materials set forth above, including my application of the knowledge of a person of ordinary skill in the art, it is my opinion that claims 1-19 of the ’896 patent would have been obvious to one of ordinary skill in the art.

107. In particular, it is my opinion that claims 1-19 of the ’896 patent would have been obvious to a person of ordinary skill in the art based on the Grounds and respective combinations shown below:

Ground	Challenged Claims	Basis	Prior Art
1	1-9, 11-19	Obviousness	*Guo* and *Intel*
2	10	Obviousness	*Guo* and *ZTE*
3	1-9, 11-19	Obviousness	*5G-Standard* and *Intel*
4	10	Obviousness	*5G-Standard* and *ZTE*

XII. THE CHALLENGED CLAIMS ARE UNPATENTABLE OVER THE PRIOR ART

108. In my opinion, claims 1-19 would have been rendered obvious to one skilled in the art based on the prior art at the earliest priority date of the ’896 patent.

A. Ground 1: Claims 1-9 and 11-19 Are Rendered Obvious by *Guo* in View of *Intel*

1. Rationale for Combining *Guo* and *Intel*

109. *Guo* describes a UE for use with the 5G Standard. *Guo*, [0044]-[0048], [0052], [0098]-[0099], [0105], [0121]. *Guo*'s UE is configured to determine a receive (Rx) beam based on a spatial QCL assumption a QCL, to receive PDSCH and/or aperiodic CSI-RS. *Guo*, Abstract, [0012]-[0014], [0145]-[0147], [0185], [0189]. Regarding the PDSCH, *Guo* discloses that "a downlink DCI can signal the information of Rx beam for the corresponding PDSCH that is scheduled by that downlink DCI." *Guo*, [0122]. The signaled Rx beam information includes "the spatial QCL assumption for DMRS antenna ports of this allocated PDSCH." *Guo*, [0122]. However, *Guo* teaches that the UE may meet a difficulty in using the signaled Rx beam to receive the PDSCH if the scheduling offset between the downlink DCI and the PDSCH is too small. *Guo*, [0124]. To solve this problem, *Guo* teaches a method of having the UE to use a pre-configured Rx beam (i.e., QCL assumption of the CORESET with the lowest CORESET ID) to receive the PDSCH:

> … if the offset between reception of the DL DCI and the corresponding PDSCH is less than the threshold T, the UE may assume that the antenna ports of DMRS of PDSCH are quasi co-located based on the TCI state used for PDCCH quasi-co-location indication of the lowest CORESET ID in the latest slot where one or

> more CORESETs is configured for that UE. The quasi co-location includes spatial QCL, i.e., spatial Rx parameter.

Guo, [0134].

110. *Guo* describes the above problem and solution in connection with PDSCH, but a POSITA would have appreciated that the same would apply to the reception of CSI-RS, due to the similarity between the ways used by the UE to receive the PDSCH and CSI-RS. For example, same as the PDSCH reception, *Guo* discloses that a downlink DCI can be used to trigger[6] a CSI-RS and signal the QCL assumption used for receiving the CSI-RS. *Guo*, [0189]. Thus, a POSITA would have expected that the UE would experience similar reliability in using the signaled Rx beam to receive the CSI-RS if the scheduling offset between the downlink DCI and the CSI-RS is too small. *See Guo*, [0124]. And a POSITA would have sought to use the same solution under this condition, namely, using a

[6] *Guo* discloses the DCI "trigger[s]" the transmission of one or more CSI-RS resources. *Guo*, [0189]. Here, a POSITA would understand the "trigger" is a synonym of "schedule," because the DCI determines the transmission occasions of the CSI-RS. Moreover, a POSITA would understand the CSI-RS triggered by the DCI is an aperiodic CSI-RS because periodic CSI-RS does not need to be triggered by a DCI.

pre-configured QCL assumption to receive the CSI-RS. *See Guo*, [0134]. Indeed, the 5G Standard uses the same "scheduling offset" for both the aperiodic CSI-RS and the PDSCH.

111. Indeed, the 5G Standard that *Guo*'s UE is aimed to comport with contemplated this solution for receiving the CSI-RS. It specified that "the UE applies a default QCL assumption" when "the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources … is smaller than the UE reported threshold." *5G-Standard*, 40. The Standard also specified that a UE uses the CORESET with the "lowest" ID of all CORESETs (whether monitored or not) configured for the UE in the current time slot and active BWP. *5G-Standard*, 26.

112. Relatedly, *Intel*, a 3GPP meeting proposal aimed to improve the 5G Standard and the UEs (like *Guo*'s) that practice the 5G Standard, recommended using the following default beam (i.e., default QCL assumption) to receive a CSI-RS when the scheduling offset between the DCI and the CSI-RS is smaller than a UE reported threshold:

> The ***default beam for CSI-RS for CSI acquisition follows*** the TCI state in ***monitoring CORESET in active BWP in latest slot with lowest CORESET ID*** when multiple CORESETs are configured.

Intel, 1 (original bold and italics removed; emphases added). As explained by *Guo*, "the TCI state is used to indicate QCL configuration to receive that CSI-RS resource." *Guo*, [0185]; *see also 5G-Standard*, 26, 40. Thus, *Intel* proposed using the CORESET "with [the] lowest CORESET ID" amongst only those CORESETs "monitor[ed]" by the UE. The QCL assumption of that monitored CORESET, according to *Intel*, would then be used to receive the aperiodic CSI-RS. *Intel*, 1. *Intel* explains that this is "better" because it allows the beam used for receiving an aperiodic CSI-RS to measure channel conditions, to also be used to receive the PDSCH scheduled by the monitored CORESET. *Intel*, 1. This would result in more accurate reception of the PDSCH.

113. In my opinion, a POSITA would have found it obvious to configure *Guo*'s 5G UE to use *Intel*'s proposed improvement of defaulting to the QCL of the "monitor[ed]" CORESET with the lowest ID when the scheduling time offset is below the UE reported threshold.

a. Motivation to Combine

114. In my opinion, a POSITA would have been motivated to combine the teachings of *Guo* and *Intel* for several reasons.

115. First, a POSITA would have appreciated that *Intel*'s method benefits *Guo*'s 5G UE. As *Intel* itself teaches, "it is better" that the CSI-RS and the PDSCH use the same "default beam" because this allows using the CSI-RS to detect the channel conditions and update the antenna beam pattern used for receiving the PDSCH. *Intel*, 1-2. Thus, by modifying *Guo*'s 5G UE to perform *Intel*'s improved

method, *Guo*'s UE can "better" determine the default beam for the CSI-RS when multiple CORESETs are configured for the UE. A POSITA would recognize that this enables *Guo*'s UE's to better understand the channel conditions of the PDSCH, thereby receiving the PDSCH more accurately.

116. Second, the 5G Standard that would be followed by *Guo*'s UE provided a motivation or suggestion to apply *Intel*'s teaching. Specifically, the 5G Standard specified that "a default QCL assumption" would be used to receive the aperiodic CSI-RS resources when "the scheduling offset … is smaller than the UE reported threshold." *5G-Standard*, 40. While the 5G Standard did not specify what the "default QCL assumption" is, *Intel* substantiates it. *Intel*, 1. Specifically, *Intel* proposes that the QCL of the "monitor[ed]" CORESET with the "lowest" ID be used for the CSI-RS. *Intel*, 1. A POSITA would understand that, by modifying *Guo*'s 5G UE to include *Intel*'s 5G improvement, *Guo*'s UE would avoid arbitrary beam switching and use, instead, the default proposed by *Intel*. A POSITA thus would have been motivated to apply *Intel*'s teaching to *Guo*'s 5G UE that is ready for *Intel*'s improvement.

117. Third, *Guo* even identifies the problem with CSI-RS reception that *Intel* resolves. Specifically, in discussing the application of a QCL assumption (i.e., receiving beam direction) for receiving a PDSCH, *Guo* describes that a 5G UE "might meet a difficulty in choosing the proper Rx beam [for that PDSCH]" when

the DCI and that PDSCH "are transmitted in the same slot." *Guo*, [0125]. As *Guo* explains, "a downlink DCI can signal the information of Rx beam for the corresponding PDSCH that is scheduled by that downlink DCI," *Guo*, [0122], so "[o]nly after finishing decoding the DCI" can the UE determine which beam receives the PDSCH. *Guo*, [0125]. *Guo* recognizes (as did the 5G Standard), though, that if the "scheduling offset" between the DCI and the PDSCH is too small, the UE wouldn't have sufficient time to switch to the Rx beam signaled by the downlink DCI. *Guo*, [0125]-[0126], [0134] ("… if the offset between reception of the DL DCI and the corresponding PDSCH is less than the threshold T …"); *5G-Standard*, 26-27 ("… if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *Threshold-Sched-Offset* …"). While *Guo* and the 5G Standard describe the above in connection with the PDSCH, a POSITA would have understood that the same problem applies to the aperiodic CSI-RS because conventionally its Rx beam is signaled in the same way—a downlink DCI used for triggering (i.e., scheduling) an aperiodic CSI-RS also signals the information of the Rx beam for that CSI-RS. *Guo*, [0189]; *supra*, ¶110. Thus, a POSITA reading *Guo* would have recognized the need of choosing a proper Rx beam for the aperiodic CSI-RS when the scheduling offset of the CSI-RS (i.e., the time offset between the scheduling DCI and the CSI-RS) is less than a UE reported threshold. A POSITA would have realized that *Intel* addresses this exact problem as *Intel* states its proposal is for "when [the] scheduling offset is before [i.e., less than the] UE reported threshold." *Intel*, 1. Thus, a POSITA would have been motivated to use *Intel*'s proposed method to solve the aperiodic CSI-RS beam switching problem raised by *Guo*.

b. Expectation of Success

118. A POSITA would have had a reasonable expectation of success in combining *Guo* and *Intel*, and would have expected this combination to yield a predictable solution. The combination requires nothing more than a direct incorporation of *Intel*'s teaching into *Guo*'s 5G UE, to determine the default QCL assumption for receiving an aperiodic CSI-RS when the time offset between a scheduling DCI and the CSI-RS is smaller than a threshold. The resulting combination would thus be "better" by determining the default QCL (coming from the particular CORESET corresponding to the claimed "first CORESET") for receiving the CSI-RS when the scheduling offset is too small.

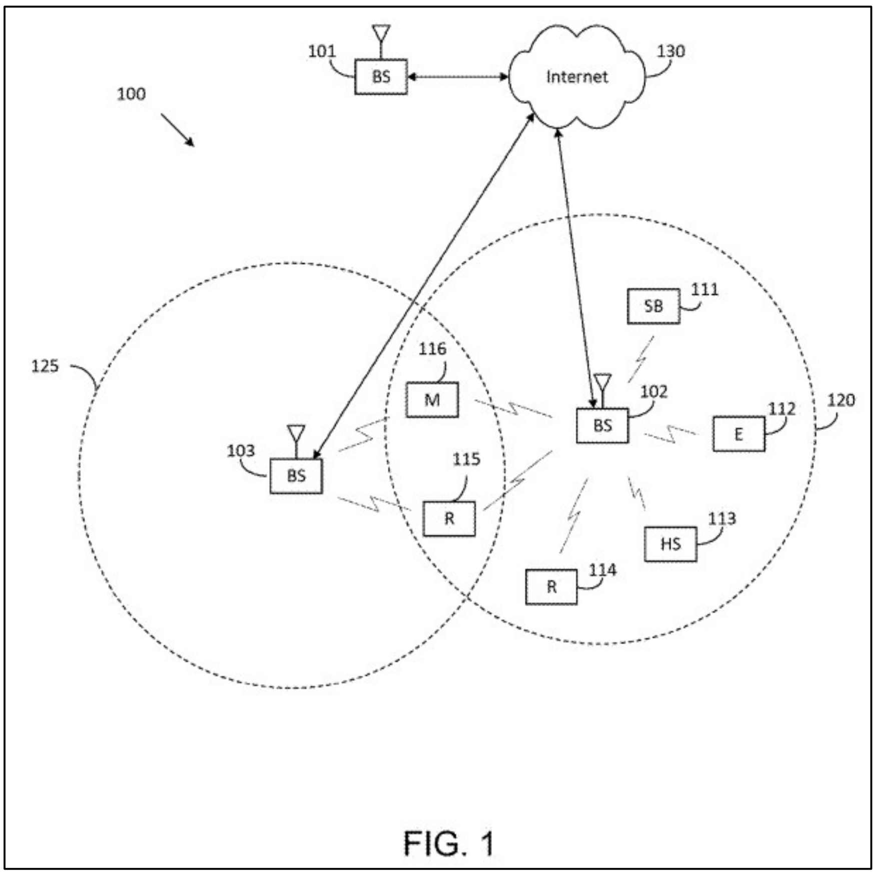
119. Moreover, a POSITA would have had a reasonable expectation of success in making this combination because *Intel*'s proposed solution (for determining the default receiving beam for CSI-RS) comports with *Guo*'s 5G UE and the then-existing 5G Standard. Namely, *Intel*'s 5G solution, as well as *Guo*'s and the 5G Standard's approach, all taught using the CORESET with the lowest CORESET ID to determine a default QCL assumption. *Guo*, [0134]; *5G-Standard*,

26-27; *Intel*, 1. *Intel* further taught it was "better" to do this amongst only the "monitor[ed]" CORESETs, *Intel*, 1, suggesting that applying *Intel*'s approach to the prior art UEs (like *Guo*'s UE) would yield a predictable result. Moreover, the fact that *Intel* was a proposal submitted to the 5G standard-setting body, and discussed in 3GPP meetings at the time, suggests that POSITAs would have considered *Intel*'s recommended solution to be a viable way of configuring the UEs and would have readily adopted *Intel*'s proposed solution as an improvement to *Guo*'s UEs. In fact, multiple other 3GPP member companies also proposed the same solution of making the default beam for receiving aperiodic CSI-RS to be the same as the default beam for receiving PDSCH, suggesting that this was a predictable solution and POSITAs would have had a reasonable expectation of success. Ex. 1015 ("*Vivo366*"), 2 ("For AP-CSI-RS for CSI acquisition, default QCL assumption can be the same as that for PDSCH, e.g. same scheduling offset threshold and same rule for QCL parameters (follow lowest CORESET-ID)."); Ex. 1023 ("*OPPO*"), 7 ("The default QCL assumption of aperiodic CSI-RS is the same as that of PDSCH."); Ex. 1024 ("*Sony*"), 5 ("Otherwise, this UE has to ignore the indicated TCI states and apply a default TCI state. From our understanding, a simple solution is that in that slot a UE should assume aperiodic CSI-RS QCL-ed in Type D with DMRS of PDSCH."). Additionally, implementing the proposed combination would only require modifying the software of *Guo*'s UE to perform the functions intended by *Intel*, which was well within the ordinary skill of art at the time of the '896 patent.

2. Independent Claim 1

a. [1Preamble]: "A user equipment (UE) comprising:"

120. *Guo* discloses a UE for use with the 5G Standard. *Guo*, [0052]. As shown in *Guo*'s FIG. 1, network 100 includes multiple UEs 111-116 communicating with BSs 101, 103. *Guo*, [0050]-[0052].



Guo, FIG. 1.

b. [1a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

121. *Guo* discloses [1a]. *Guo*'s UE, like any UE for use with the 5G Standard, includes the claimed elements. For example, *Guo*'s FIG. 3 shows that each UE has a memory 360 storing an operating system 361 and applications 362, both of which are "computer-executable instructions," as claimed. *Guo*, [0067], [0071], FIG. 3; *see also Guo*, [0017] (explaining that "application" refers to "computer programs, software components, [or] sets of instructions …"). *Guo* further explains that memory 360 includes non-transitory computer-readable media, such as random access memory ("RAM"), flash memory, or read-only memory ("ROM"). *Guo*, [0073]; *see also Guo*, [0017] (explaining the disclosed "non-transitory computer readable medium").

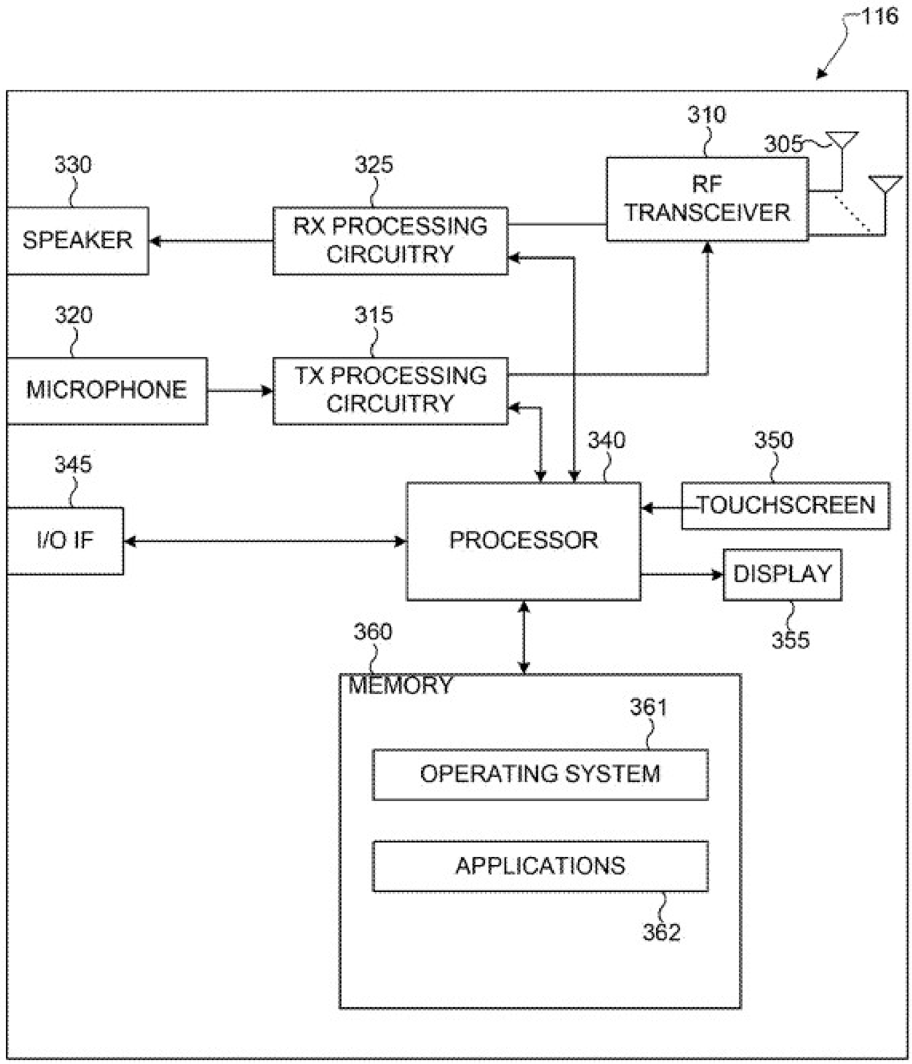


FIG. 3

Guo, FIG. 3.

c. **[1b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"**

122. *Guo* discloses [1b]. *Guo*'s UE, like any UE for use with the 5G Standard, includes these claimed elements. *Guo*'s FIG. 3 (reproduced above)

shows that *Guo*'s UE has a processor 340 coupled to memory 360. *Guo*, [0067], [0073], FIG. 3. Processor 340 executes the instructions in memory 340 to perform the 5G operations. *Guo*, [0070]-[0071]. This simply comports with any 5G UE like *Guo*'s.

d. [1c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and"

123. In my opinion, *Guo* discloses [1c]. First, *Guo* discloses "a plurality of" CORESETs "configured for the UE," as claimed. A POSITA would understand the 5G network in *Guo* supports up to twelve CORESETs for a UE, with up to three within a BWP. *Guo*, [0044]-[0048], [0052]-[0053], [0098]-[0099], [0105], [0121]; Ex. 1018, *TS-38.211*, § 4.4.5 ("A UE can be configured with up to four bandwidth parts in the downlink with a single downlink bandwidth part being active at a given time."); 3GPP TS 38.331 v15.3.0 ("*TS-38.331*"; Ex. 1021), 238 ("The network configures at most 3 CORESETs per BWP per cell (including UE-specific and common CORESETs)."); *Intel*, 1 (describing "multiple CORESETs are configured" for a UE).

124. Moreover, *Guo* discloses:

> In one example, if the offset between reception of the DL DCI and the corresponding PDSCH is less than the threshold T, the UE may assume that the antenna ports of DMRS of PDSCH are quasi co-

> located based on the TCI state used for PDCCH quasi-co-location indication of the lowest CORESET ID in the latest slot where one or more CORESETs is configured for that UE.

Guo, [0134]. *Guo*'s use of "one or more" also indicates that more than one CORESET are configured for the UE. And *Guo*'s use of the "lowest CORESET ID (*Guo*, [0134]; *see also Guo*, [0133]) indicates that more than one CORESET are configured for its UE, as the UE would otherwise have no need to select the "lowest" ID.

125. Second, *Guo* discloses that the UE will "monitor" at least one of these CORESETs within an "active [BWP] of a serving cell in a time slot," as claimed. Indeed, a POSITA would understand that a fundamental feature of 5G is that the UE monitors at least one CORESET in the active BWP, where that BWP is associated with a serving cell to enable communication between each UE and BS. 3GPP TS 38.213 v15.3.0 ("*TS-38.213*"; Ex. 1019), 69 ("A UE monitors a set of PDCCH candidates in one or more control resource sets on the active DL BWP on each activated serving cell … ."); 3GPP TS 38.321 v15.3.0 ("*TS-38.321*"; Ex. 1020), § 5.15 ("For each activated Serving Cell configured with a BWP, the MAC entity [of a UE] shall: 1>if a BWP is activated: … 2>monitor the PDCCH on the BWP … ," and "1>if a BWP is deactivated: … 2>not monitor the PDCCH on the BWP … ."); *Intel*, 1 (discloses a UE "monitor[s] CORESET in active BWP in latest slot"); *Intel*, 2 (disclosing "one or more CORESETs within the active BWP

of the serving cell”). *Guo* comports with this basic 5G feature, explaining that each UE is associated with a “serving cell” to receive “data and control transmission.” *Guo*, [0114]. *Guo* discloses its “UE is configured to monitor” a received CORESET. *Guo*, [0147]. As shown in FIG. 12, *Guo*’s UE monitors CORESETs for whether they contain a DCI for scheduling a PDSCH, in time slots configured “in a first BWP.” *Guo*, [0124], [0135], [0147].

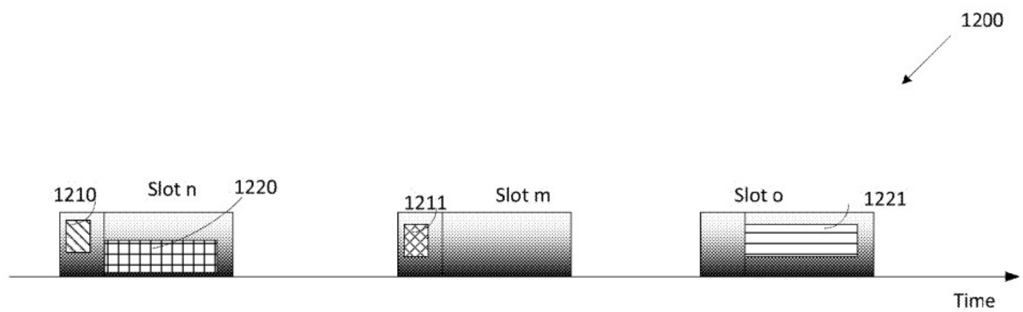


FIG. 12

Guo, FIG. 12.

e. [1d]: “apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),”

126. The *Guo/Intel* combination renders obvious [1d]. As explained in Section XII.A.1, *Intel* expressly discloses an improvement to *Guo*’s 5G UE and the then-existing 5G Standard—proposing applying the following default beam for

receiving CSI-RS when the scheduling offset if smaller than the "when [the] scheduling offset is before [i.e., smaller than the] UE reported threshold":

> The ***default beam for CSI-RS for CSI acquisition follows*** the TCI state in ***monitoring [a] CORESET in [an] active BWP in [the] latest slot with [the] lowest CORESET ID*** when multiple CORESETs are configured.

Intel, 1 (original bold and italics removed; emphases added). *Guo* explains that "the TCI state is used to indicate QCL configuration to receive that CSI-RS resource." *Guo*, [0185]; *see also 5G-Standard*, 26 (explaining that the TCI state defines the QCL assumption). Thus, *Intel* teaches applying the QCL assumption used in monitoring the CORESET in the active BWP in the latest slot with the lowest CORESET ID to receive an aperiodic CSI-RS. Here, *Intel*'s monitored CORESET in the active BWP in the latest slot with the lowest CORESET ID teaches "a first CORESET of a set of one or more monitored CORESETs," as claimed. And Intel's QCL assumption in monitoring this CORESET teaches the claimed "first Quasi Co-Location (QCL) assumption." Finally, as described in Section XII.A.1, *supra*, it would have been obvious to combine the teachings of *Guo* and *Intel* to arrive at the claimed UE.

f. [1e]: "wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

127. The *Guo/Intel* combination renders obvious [1e]. As discussed for [1d], *Intel* teaches applying the QCL assumption in monitoring a CORESET (the claimed "first CORESET") to receive an aperiodic CSI-RS, and this monitored CORESET is associated with the "lowest CORESET ID when multiple CORESETs are configured ." *Intel*, 1; *supra*, Section XII.A.2.e.

128. Regarding the claim requirement that the monitored CORESET is associated with a "monitored search space," this is implicitly taught by both *Guo* and *Intel*. It was well known that a 5G UE monitors a CORESET by monitoring (blind decoding) one or more of its search spaces. *Supra*, Section VI.D.3. In fact, the 5G Standard implemented by *Guo* and *Intel* specified that "the UE is provided … an association between the search space set *s* and a control resource set *p* by higher layer parameter *controlResourceSetId*." 3GPP TS 38.213 v15.3.0 ("*TS-38.213*"; Ex. 1019), 71-72; Ex. 1021, *TS-38.331*, 309 (describing that the "*SearchSpace* information element" may signal the "ControlResourceSetId"); *ZTE*, 12-13 (explaining that the "lowest CORESET-ID" refers to "a CORESET associated with one search space"). A POSITA would thus readily understand that *Intel*'s "monitor[ed]" CORESET has a "monitored search space configured with" a

lowest CORESET ID among the set of one or more monitored CORESETs, as claimed.

129. Finally, as discussed in Section XII.A.1, *supra*, it would have been obvious to combine the teachings of *Guo* and *Intel* to arrive at the claimed UE.

3. Claim 2

a. [2a]: "The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain, from the first CORESET, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS,"

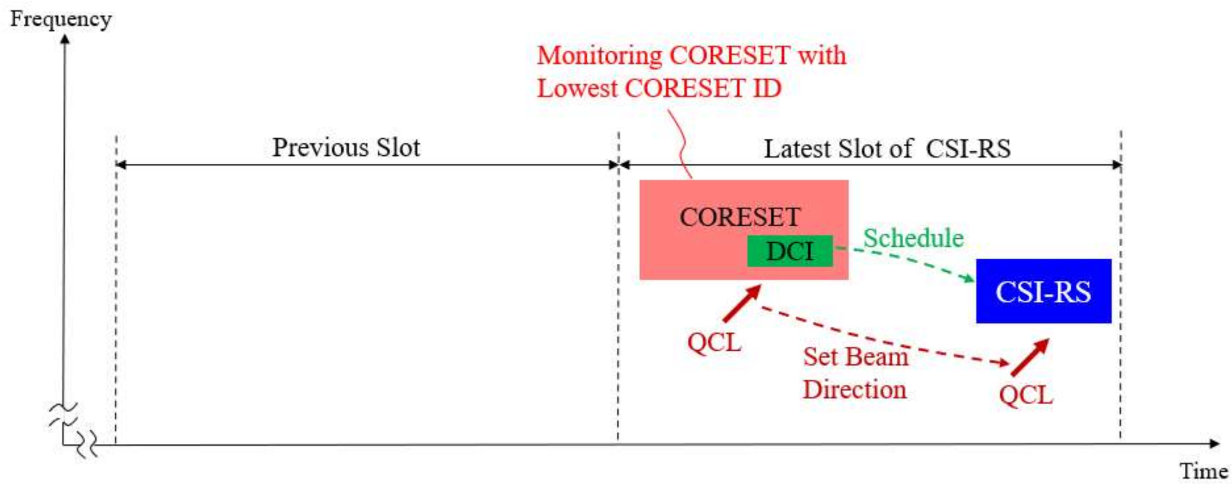
130. In my opinion, the *Guo/Intel* combination renders obvious [2a]. As explained for [1d] and [1e] (s*upra*, Sections XII.A.2.e, XII.A.2.f), *Guo*/*Intel* discloses the "first CORESET" of claim 2. Element [2a] additionally requires that the DCI from this "first CORESET" be used to "schedul[e] the aperiodic CSI-RS."

131. This was done by 5G UEs (like *Guo*'s UE) implementing the 5G Standard. Specifically, the Standard instructed that a "UE may be configured with a DCI field for triggering the aperiodic ZP-CSI-RS." *5G-Standard*, 25. While here the 5G Standard stated that UEs "may" do this, UEs normally did do this. Indeed, *Guo* itself explicitly discloses an embodiment where the "DCI triggers the transmission of CSI-RS transmission in the same slot." *Guo*, [0190]. In this embodiment, *Guo* teaches that the UE applies the QCL of a first CORESET to

receive the aperiodic CSI-RS and uses a DCI from the *same* first CORESET to schedule the aperiodic CSI-RS:

> In one embodiment, when one DCI triggers the transmission of CSI-RS transmission in the same slot, the UE can be request[ed] to assume use the QCL configuration configured to the CORESET where the DCI is received to receive and measure the CSI-RS transmission.

Guo, [0190]. As discussed in Section XII.A.1, it would have been obvious to combine the teachings of *Guo* and *Intel* to arrive at the claimed UE. Moreover, a POSITA would have been motivated to use the *same* CORESET to set the beam direction (i.e., apply the QCL assumption) and schedule the time-frequency resources used for receiving the aperiodic CSI-RS, because it avoids the need of mapping the CSI-RS to different CORESETs, thereby simplifying the operations of the BS and UE. Additionally, a POSITA would have a reasonable expectation of success for doing so. As I illustrate below, it is a simple combination of *Intel*'s teaching of using the QCL assumption of the "monitoring CORESET in … [the] latest slot with [the] lowest CORESET ID" to receive the CSI-RS, and *Guo*'s teaching of using a DCI in the same monitoring CORESET to schedule "the transmission of CSI-RS transmission in the same slot." *Intel*, 1; *Guo*, [0190]. By monitoring that CORESET, the UE would be expected to obtain the DCI therein for scheduling the CSI-RS.

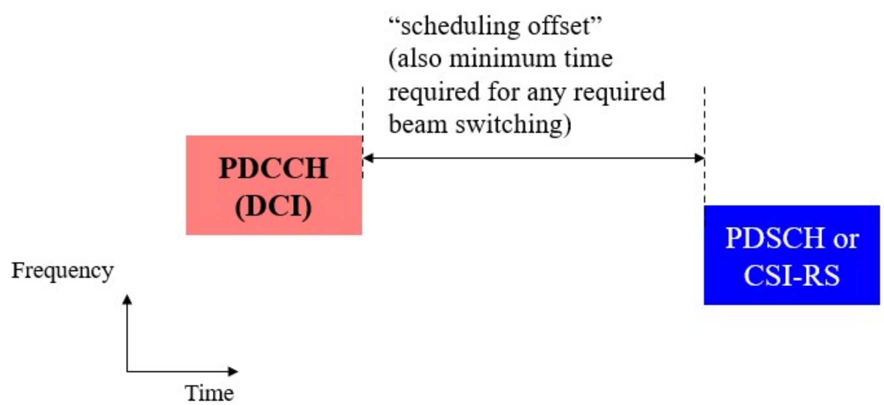


b. [2b] "wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold."

132. The *Guo/Intel* combination renders obvious, if not implicitly discloses, [2b]. The claim language here specifically defines that the "scheduling offset" is between "an end of a last symbol" of the PDCCH and "a beginning of a first symbol" of a resource carrying the aperiodic CSI-RS.

133. *Guo* discloses that the scheduling offset "is the minimum time duration this UE needs" so that this UE can decode the DCI before "starting" receipt of the scheduled transmission. *Guo*, [0135] (mentioning this for PDSCH). Although *Guo* discusses the scheduling offset in the context of PDSCH reception, a POSITA would have appreciated that the same would apply to the reception of CSI-RS, due to the similarity between the ways used by the UE to receive the PDSCH and CSI-RS. *Supra*, Section XII.A.1. As the below diagram illustrates, the

UE needs this time to switch from one beam (containing the DCI used to schedule receipt of a transmission) to another beam (containing the actual transmission). If the UE does not have enough time, then the UE needs to make a QCL assumption, resulting in the reuse of a beam pre-configured for the PDSCH transmission to also be used for the aperiodic CSI-RS transmission. *Guo*, [0128] (explaining that if the scheduling offset is below the threshold, then a QCL assumption can be used); s*ee also supra*, Sections XII.A.2.e, XII.A.2.f (explaining *Guo/Intel*'s resulting UE uses the QCL of the monitored CORESET with lowest ID to receive the CSI-RS when the "scheduling offset" is less than a "threshold"). All of this comports with the then-existing 5G Standard, instructing that this offset is between "the last symbol" of the PDCCH and "the first symbol" of the aperiodic CSI-RS resources. *5G-Standard*, 40.



134. Accordingly, in my opinion, the *Guo/Intel* combination renders obvious – if not implicitly discloses—that the offset is between "an end" of the

PDCCH's last symbol and "a beginning" of the CSI-RS's first symbol, as claimed.[7]

135. Indeed, in my opinion, a POSITA would have been motivated to configure the *Guo/Intel* combination to measure the offset in this specific way because, while other ways are at least theoretically possible, the specific claim language is directed to the very offset instructed by the then-existing 5G Standard and for which *Guo*'s UE was intended. Moreover, a POSITA would have had a reasonable expectation of success in making this modification because it would simply have required a minor software change to the UE's coded instructions to measure the offset in this precise way.

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[7] I note that even Patent Owner itself urges that the 5G Standard discloses this scheduling offset as between "an end of a last symbol" and "a beginning of a first symbol." Specifically, Patent Owner's own Complaint in the district court litigation relies on this same language within the 5G Standard as disclosing [2b]. Ex. 1040, Patent Owner's Complaint, ¶ 54.

4. Claim 3

a. "The UE of claim 1, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE."

136. As explained above with regard to claim 1 (s*upra*, Section XII.A.2), the *Guo/Intel* combination renders obvious a UE that selects the "monitor[ed]" CORESET with the lowest CORESET ID from amongst the multiple CORESETs "configured" for that UE. Claim 3 further requires that the "first CORESET" of claim 1 "overlaps" a second CORESET by "at least one symbol" and that this second CORESET is "non-monitored." In other words, claim 3 broadly requires the existence of an overlapping CORESET configured for the UE that is not monitored. Notably, claim 3 is not directed to instructions configured on the UE, but simply to a CORESET scenario.

137. In practice, a UE typically receives multiple CORESETs that "overlap[] … in at least one symbol in a time domain," as claimed—including where those CORESETs are "configured to the UE," as also claimed. A POSITA would understand that *Guo/Intel*'s 5G system was designed to accommodate "for various use cases such as enhanced mobile broadband (eMBB), ultra reliable low latency (URLLC), massive machine type communication (mMTC)." *Guo*, [0010].

Thus, it typically requires multiple CORESETs to schedule different types of data traffic, such as the eMBB, URLLC, and mMTC.

138. Again, both *Guo* and *Intel* concern 5G UEs. *Supra*, Section XII.A.1. As the 5G Standard addressed, UEs may "deactivate" a current BWP and "activate" a new BWP. Ex. 1020, *TS-38.321*, 44 ("The BWP switching for a Serving Cell is used to activate an inactive BWP and deactivate an active BWP at a time."), 45 ("For each activated Serving Cell configured with a BWP, the MAC entity [of a UE] shall: 1>if a BWP is activated: … 2>monitor the PDCCH on the BWP … ," and "1>if a BWP is deactivated: … 2>not monitor the PDCCH on the BWP … ."). This could occur, for example, if the UE needed more bandwidth than that offered by the currently active BWP (e.g., if the UE downloads voluminous video data). If the BWP changes, then the BS would still transmit other CORESETs "configured to the UE" in the previous BWP. Such CORESETs in the previous or non-active BWP are not monitored. A POSITA would thus readily appreciate that the UE would encounter instances where the "first CORESET" of claim 1 "overlaps" with another CORESET (claimed "second CORESET") "in at

least one symbol in a time domain," as claimed.[8] A POSITA would understand it was common and well known for multiple CORESETs configured for a UE to overlap in time. *See*, *e.g.*, *Vivo369* (Ex. 1022), 5 ("the CORESET with lowest ID among the overlapped CORESETs"); *LG256* (Ex. 1026), 1 (teaching that "different CORESETs can be overlapped on time and/or frequency domain, which "means that CORESETs with different QCL assumptions can be overlapped on a same symbol"); *CATT* (Ex. 1027), 5 (Proposal 3 – "If CORESETs overlap and only one of them has a CSS, the UE should monitor the one with the CSS.").

139. As to the claim's requirement of a "second CORESET is a non-monitored CORESET … and the non-monitored CORESET is associated with a non-monitored search space configured to the UE," this too simply occurs when the UE switches to a new BWP. To explain, when a UE switches to a new BWP, the BS will still transmit CORESETs "configured to the UE" in the previous BWP after switching to the new active BWP. Because these CORESETs are no longer in the active BWP, such CORESETs are "non-monitored," i.e., they are "associated with a non-monitored search space configured to the UE," as claimed. Indeed, as

[8] Claim 3 does not require that the claimed "second CORESET" is in the active BWP recited in claim 1. In fact, claim 5, which further depends from claim 3, further recites that this "second CORESET" is from a "deactivated" BWP.

explained by the 5G Standard, CORESETs in a deactivated BWP are not monitored. Ex. 1020, *TS-38.321*, 45.

140. The above BWP switching was a conventional situation in 5G systems. For example, as shown below, *Lee* illustrates an example in which a UE switches from an original BWP 906 to target BWP 908. *Lee*, [0157]; *Lee Provisional*, [0153]. After the BWP switching, the UE skips monitoring the CORESETs in BWP 906, and starts to monitor the CORESETs in target BWP 908. *Lee*, [0140]; *Lee Provisional*, [0135]. Such BWP switching was common and routine in 5G systems because they allow multiple BWPs to be configured in a cell's frequency bandwidth. *Lee*, [0075]-[0079]; *Lee Provisional*, [0074]. And different BWPs may be used for different applications, for example, a UE may use a first BWP to receive high-quality low latency video streaming, while use a second BWP to receive text messages.

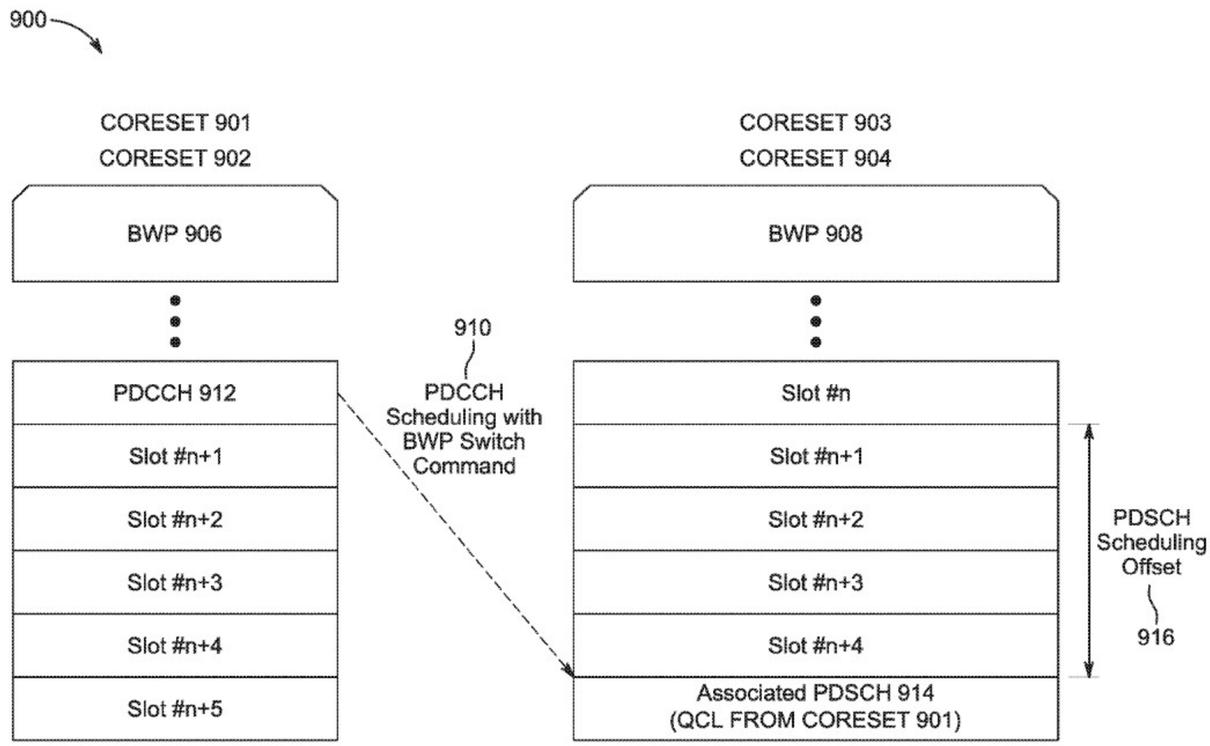

FIG. 9

Lee, FIG. 9; *Lee Provisional*, FIG. 8.

5. Claim 4

a. "The UE of claim 3, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID."

141. In my opinion, the *Guo/Intel* combination renders obvious claim 4. Claim 4 is not directed to instructions configured on the UE, but simply to a CORESET's configuration. In this regard, the 5G Standard specified that each

CORESET has an associated "search space" and a "search space ID." Ex. 1019, *TS-38.213*, 71-72. The monitored "first CORESET" of *Guo*/*Intel* thus has a "monitored search space" and its own "search space ID," and the non-monitored "second CORESET" has a "non-monitored search space" and its own "search space ID," as claimed. This just follows the 5G Standard, which *Guo* implements. *E.g.*, *Guo*, [0052]-[0053].

142. As to the claimed scenario where the first search space ID "is lower" than the second search space ID, the 5G Standard did not restrict any numerical ordering of the search space IDs. A POSITA would understand that a first space ID being "lower" than a second search space ID is an obvious, conventional, and likely scenario. This is because the search space IDs need to be unique among the search spaces configured for a UE, so one search space ID is inevitably "lower" than another—including for a monitored search space versus a non-monitored search space. Indeed, because the IDs would not be the same, one would always be "lower" than the other, and the first would routinely be lower than the second. A POSITA would have understood it was simply a design choice to assign a lower ID to a monitored search space than a non-monitored search space. A POSITA would have found it at least obvious to try because it is consistent with *Guo/Intel*'s prioritization of monitored CORESETs over non-monitored CORESETs.

143. This was well known. For example, *Seo* discloses that the CORESET priority can be assigned according to "CORESET/Search Space Set Index," by which higher priority can be given to CORESETs associated with lower search space set indexes. *Seo*, [0165], [0177]-[0178]; *Seo Provisional*, 9. This means that the monitoring priority is given to CORESETs associated with lower search space set indexes. It follows that the search space set indexes associated with monitored CORESETs are lower than the search space set indexes associated with non-monitored CORESETs.

6. Claim 5

a. "The UE of claim 3, wherein the second CORESET is configured on one of: a deactivated Bandwidth Part (BWP); and a deactivated Secondary Cell (SCell)."

144. In my opinion, the *Guo/Intel* combination renders obvious claim 5. As described above with respect to claim 3 (*supra*, Section XII.A.4), the claimed "second CORESET" may be configured for a "deactivated Bandwidth Part (BWP)."

7. Claim 6

a. "The UE of claim 3, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain."

145. In my opinion, the *Guo/Intel* combination renders obvious claim 6. Claim 6 is also not directed to instructions configured on the UE, but again,

directed to a CORESET scenario. As explained above with respect to claim 1 (*supra*, Section XII.A.2), *Intel* and *Guo*, both of which concern the 5G Standard, explain that the UE may monitor multiple CORESETs that are close to one another, including where multiple "monitored" CORESETs have "at least one symbol" that overlap, as claimed. To explain this more, *Intel* expressly teaches using the monitored CORESET with the "lowest" ID—implicitly stating that the UE monitors multiple CORESETs. *Intel*, 1.

146. A POSITA would further understand that such multiple CORESETs may "overlap[]" in "at least one symbol in the time domain," as claimed.[9] This was well known in the 5G art. For example, *Seo* discloses that more than one of the time-overlapped CORESETs can be monitored by the UE. *Seo*, [0167]; *Seo Provisional*, 9; *see also*, *e.g.*, *NTT* (Ex. 1025), 4 (describing "a UE monitors multiple search spaces associated with different CORESETs for a given BWP of a

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[9] Figs. 1-4 and 7 of the '896 patent all show CORESETs that overlap in at least one symbol in the time domain. Notably, the patent does not ever disclose any particular functionality or system for how this would be done. This comports with the simple fact that overlapping CORSETs inevitably occur in 5G systems. And, notably, dependent claim 6 here broadly recites the existence of CORESETs monitored by the UE, rather than reciting instructions done by the UE.

serving cell" where "he search spaces are overlapped in time"); *LG256* (Ex. 1026), 1 (teaching that "different CORESETs can be overlapped on time and/or frequency domain, which "means that CORESETs with different QCL assumptions can be overlapped on a same symbol"); *CATT* (Ex. 1027), 5 (Proposal 3 – "If CORESETs overlap and only one of them has a CSS, the UE should monitor the one with the CSS.").

147. At the very least, it would have been obvious to a POSITA that the UE would encounter situations, or to configure the UE to handle such common situations, where multiple CORESETs "overlap[]" in "at least one symbol in the time domain," as claimed. Indeed, a POSITA would be motivated to do so because this would configure the UE to handle common situations, and POSITA would have had an expectation of success in doing so because to configure the UE in this way would have simply required minor software changes.

8. Claim 7

a. "The UE of claim 1, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell."

148. In my opinion, the *Guo/Intel* combination renders obvious claim 7. Like the other dependent claims, claim 7 is also not directed to instructions configured on the UE, but simply to the timing of transmissions received by the UE.

149. As discussed for [1c]-[1e] (*supra*, Sections XII.A.2.d-XII.A.2.f), *Guo/Intel* concerns a 5G UE, where that UE monitors plural CORESETs and receives "a resource carrying the aperiodic CSI-RS," as claimed. *See also 5G-Standard*, 40 (discussing relationship between CORESET information and CSI-RS). As also discussed above, *Guo*/*Intel* also renders obvious that these plural CORESETs and the CSI-RS are provided in "the active BWP of the serving cell," as claimed. *Supra*, Section XII.A.2.d ([1c]) (further explaining that a 5G UE is configured to handle plural CORESETs within the activated BWP and in one time slot).

150. As to whether these CORESETs are also provided in the "time slot," *Guo*/*Intel* discloses this too. UEs frequently receive, in practice, multiple CORESETs and a CSI-RS within the same time slot. The 5G Standard addressed this conventional scenario by teaching the use of the above-described "offset" for when CORESETs and the CSI-RS occur too close (e.g., within the same slot). *Supra*, Sections XII.A.1, XII.A.3.b; *5G-Standard*, 40. This was a conventional, well-known feature of the 5G art. For example, as shown below, *Wilson792* discloses that "CORESETs 1110, 1112, and 1114" and "an aperiodic CSI-RS 1118" are configured in a slot 1142 and in an active BWP. *Wilson792*, [0096]; *Wilson792 Provisional*, [0094]. Among these CORESETs, "the CORESET 1110

… transmit[s] [the] aperiodic CSI-RS 1118." *Wilson792*, [0096]; *Wilson792 Provisional*, [0094].

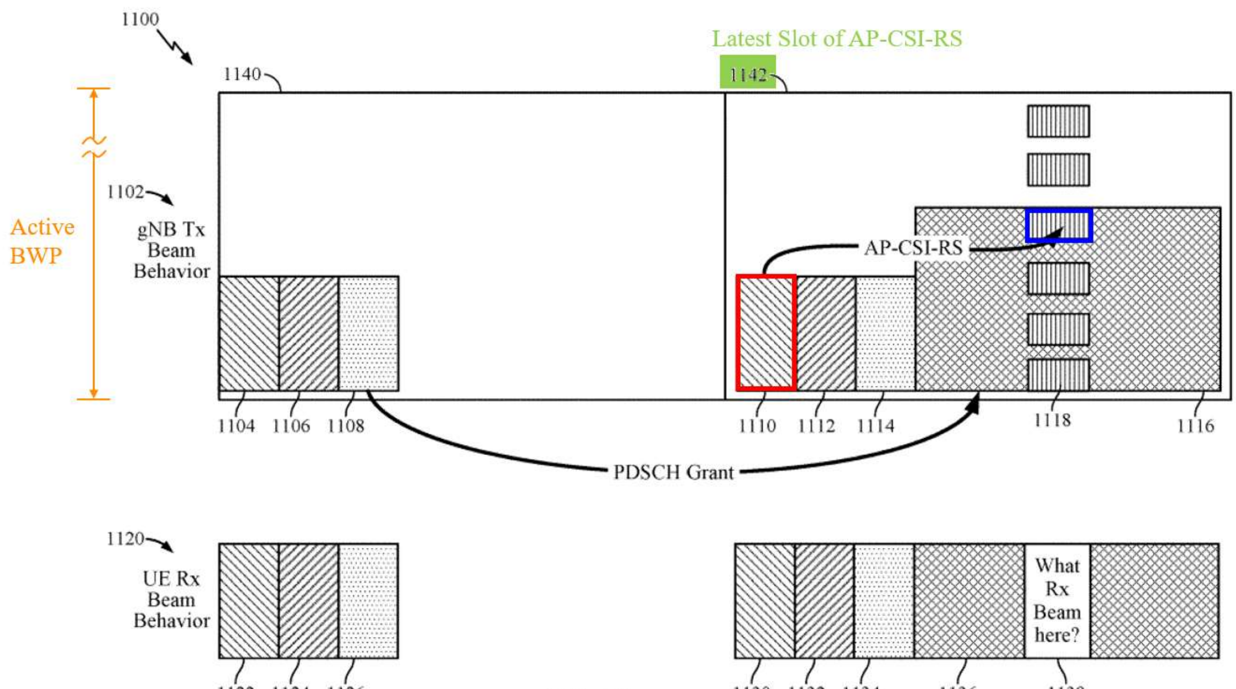


FIG. 11

Wilson792, FIG. 11; *Wilson792 Provisional*, FIG. 11.

151. *Guo* also addresses this by even disclosing an embodiment where CORESETs and the CSI-RS are "in the same slot." *Guo*, [0190]. Thus, at the very least, it would have been obvious to a POSITA that the UE would encounter situations, or could be configured to handle situations, where the plural CORESETs and the CSI-RS are in the same "time slot." Indeed, a POSITA would have been motivated to do so because this would configure the UE to handle common scenarios, and POSITA would have had an expectation of success in

doing so because to configure the UE in this way would have simply required minor software changes.

9. Claim 8

a. [8a]: "The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first CORESET; and"

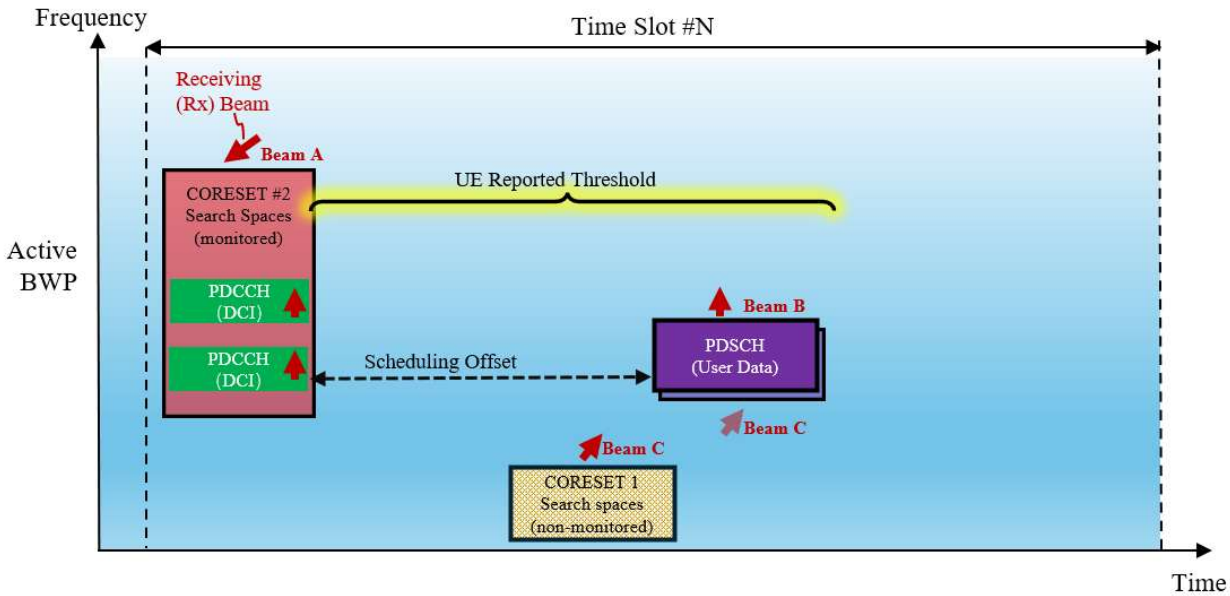
152. In my opinion, the *Guo/Intel* combination renders obvious [8a]. [8a] recites the well-known and fundamental 5G feature of using the DCI in a CORESET to schedule the PDSCH, which *Guo/Intel* discloses. *Guo*, [0147]. Particularly, as discussed for [1d]-[1e], the claimed "first CORESET" is taught by *Intel*'s "monitoring CORESET." *Intel*, 1; *supra*, Sections XII.A.2.e-XII.A.2.f. By monitoring that CORESET, the UE obtains from that CORESET a scheduling DCI of a PDSCH. *Guo*, [0145], [0147].

b. [8b]: "apply a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"

153. In my opinion, the *Guo/Intel* combination renders obvious [8b]. As detailed above for claim 1 (*supra*, Section XII.A.2), *Guo*/*Intel* discloses the claimed "first CORESET." According to the 5G Standard, the DCI from this CORESET would be obtained to schedule a PDSCH. *Guo*, [0133]-[0134].

154. However, per the 5G Standard, and as *Guo* itself explains, if the "offset" between a CORESET's DCI and the corresponding PDSCH is "less than the threshold," then the UE may make a QCL assumption based on information associated with the lowest CORESET ID. *Guo*, [0134]; *5G-Standard*, 26.

155. The figure below illustrates this situation. Here, per the then-existing 5G Standard, the UE would use the QCL assumption of CORESET #1 (the claimed "second CORESET") to schedule receipt of the PDSCH. In other words, in the figure below, and when applying the above disclosure of at least *Guo*, the lowest CORESET ID in the current time slot (slot N, below) would be associated with CORESET #1 (the claimed "second CORESET"). The QCL assumption of this second CORESET is the claimed "second QCL assumption." As the below figure shows, CORESET #1 is non-monitored, e.g., because the UE did not schedule itself to do so. So, per the then-existing 5G Standard, the UE would use the QCL of CORESET #1 because it has the lowest ID.

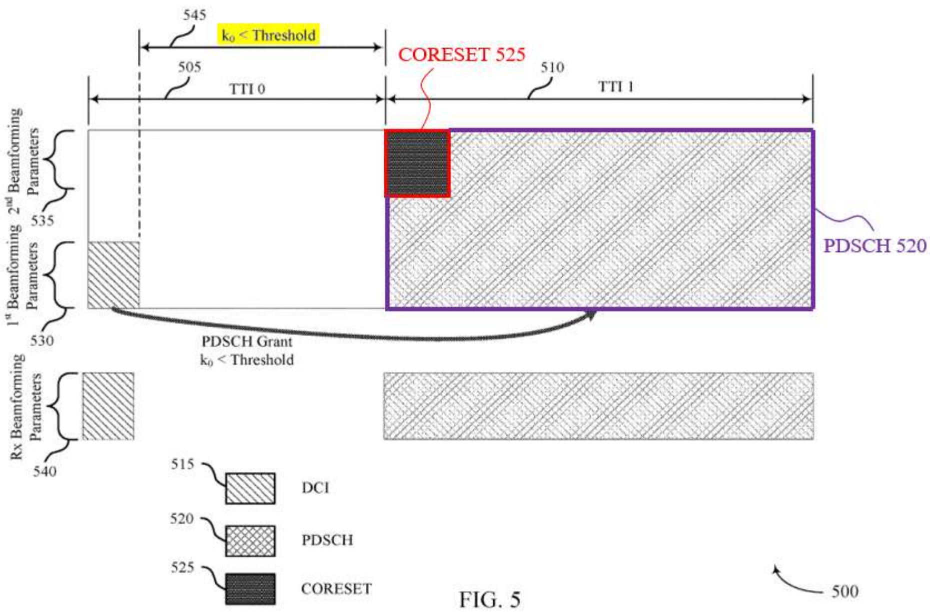


156. Claim 8 here, unlike claim 1, does not require that this "second CORESET" is monitored or that the "second QCL assumption" is associated with the "lowest" ID. Claim 9 does define, however, that this "second CORESET" is "non-monitored." The UE's handling of this "second CORESET" is different in this regard. Moreover, the resulting UE of *Guo*/*Intel* may thus be configured to handle: (a) CORESETs (such as the "first CORESET") per the *Guo*/*Intel* combination for scheduling receipt of the CSI-RS, and (b) CORESETs (such as the "second CORESET") per the *Guo*'s disclosure consistent with the then-existing 5G Standard for scheduling receipt of the PDSCH. At the very least, a POSITA would have found it obvious for the UE to do this, such as for situations where the UE moves to a geographic region requiring either approach (a) or (b).

157. As to the claim language that the "scheduling offset" is between "an end of a last symbol" of the PDCCH and "a beginning of a first symbol" of the PDSCH, *Guo* effectively discloses this too, if not rendering this particular way obvious. *See Supra* XII.A.3.b; *see also supra* n.7 (even Patent Owner interprets the 5G Standard as disclosing the offset is between "an end of a last symbol" and "a beginning of a first symbol"); *supra*, Section XII.A.1 (explaining the Standard's "offset" is the same for both CSI-RS and PDSCH).

c. [8c]: "wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain."

158. In my opinion, the *Guo/Intel* combination renders obvious [8c]. [8c] recites a conventional situation in 5G in which a CORESET (including the PDCCH therein) overlaps with a PDSCH in at least one symbol in a time domain. Ex. 1019, *TS-38.213*, 70 (5G Standard addressing situation where the "PDSCH overlaps in at least one symbol with a PDCCH" that the "UE monitors in a Type1-PDCCH common search space …"). For example, the above figure for [8b] shows this overlap. As another example, as shown below, *Wilson445* discloses a case in which PDSCH 520 overlaps with CORESET 525. *Wilson445*, [0111]-[0112].



Wilson445, FIG. 5; *Wilson445 Provisional*, FIG. 5.

159. A POSITA thus would understand that *Guo*'s CORESET with the lowest CORESET ID in the latest slot (the "second CORESET" in Section XII.A.9.b ([8b]), *supra*) would overlap with the PDSCH in at least one symbol in a time domain in certain applications, where the scheduling offset for the PDSCH is small, such as when that CORESET is associated with a Type1-PDCCH common search space.

10. Claim 9

a. "The UE of claim 8, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE."

160. In my opinion, the *Guo/Intel* combination renders obvious claim 9. As discussed above for claim [8b] (*supra* Section XII.A.9.b), the second CORESET is a "non-monitored" CORESET.

11. Claims 11-19

161. Claims 11-19 are substantially the same as claims 1-9 discussed above. *Supra*, Sections XII.A.2-XII.A.10. The main difference concerns the preamble. Specifically, while claims 1-9 are directed to a UE device configured to perform method steps, claims 11-19 are directed to the "method" itself. Thus, for the same reasons I discuss above with respect to claims 1-9, the *Guo*/*Intel* combination also renders obvious the method of claims 11-19. *Supra*, Sections XII.A.2-XII.A.10.

B. Ground 2: Claim 10 Is Rendered Obvious by *Guo* in View of *ZTE*

1. Rationale for Combining *Guo* and *ZTE*

162. *Guo*, contemplating a UE for use with the 5G Standard (*Guo*, [0044]-[0048], [0052], [0098]-[0099], [0105], [0121]), discloses a method for determining a QCL to receive PDSCH: "if the [scheduling offset for a PDSCH] Δ_t is less than

(or equal to) some threshold T, the UE can be configured to use a secondary spatial QCL assumption configuration to calculate the Rx beam for reception of the corresponding scheduled PDSCH in the same slot." *Guo*, [0128]. And *Guo* also discloses that the secondary spatial QCL assumption for receiving the PDSCH can be a QCL assumption of a CORESET, namely, the "PDCCH quasi-co-location indication of the lowest CORESET ID in the latest slot where one or more CORESETs is configured for that UE." *Guo*, [0134]. This is the same as that specified by the 5G Standard existing before the time of the '896 patent. *Compare Guo*, [0134], *with 5G-Standard*, 26-27 ("the QCL parameter(s) used for PDCCH quasi co-location indication of the lowest *CORESET-ID* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are configured for the UE"). Neither *Guo* nor the then-existing 5G Standard, however, expressly disclosed that when the "scheduling offset" is less than a threshold, the UE will apply the QCL assumption for receiving the PDSCH from the CORESET having the "lowest" ID amongst only the "monitored" CORESETs, as claimed.

163. *ZTE*, though, proposed to improve this feature in *Guo* and the then-existing 5G Standard. Specifically, *ZTE* proposed that the CORESET with the "lowest" CORESET ID should be a CORESET "associated with at least one search space set monitored by the UE":

> ***When the time offset between*** the reception of the DL ***DCI and the corresponding PDSCH is smaller than a threshold*** Threshold-Sched-Offset, [the] UE obtains [a] QCL parameter from the CORESET with the ***lowest CORESET-ID***[,] which [is] associated with at least one ***search space set monitored by [the] UE*** in the latest slot … [if] the PDSCH and the CORESET are in the same serving cell.

ZTE, 12-13 (original italics removed; emphases added).

164. In view of *ZTE*'s recommendation, a POSITA would have found it obvious to modify *Guo*'s secondary QCL assumption for receiving the PDSCH (when the scheduling offset is less than the threshold) to be the QCL of a CORESET with the lowest CORESET-ID associated with at least one search space set monitored by the UE.

a. Motivation to Combine

165. In my opinion, a POSITA would have been motivated to combine the teachings of *Guo* and *ZTE* for several reasons.

166. First, a POSITA would have appreciated that *ZTE*'s improvement benefits *Guo*'s 5G UE. More specifically, by modifying *Guo*'s 5G UE to include *ZTE*'s 5G improvement, *Guo*'s UE could improve how it determines which QCL to use when receiving multiple CORESETs, particularly when scheduling the PDSCH. Indeed, as discussed above, *Guo* uses the same lowest-CORESET-ID rule of the 5G Standard, which *ZTE* proposed to modify. *Guo*, [0134]; *5G-Standard*,

26-27; *ZTE*, 12-13. A POSITA would thus have recognized that *ZTE*'s improvement benefits *Guo*'s UE by making the UE more accurate.

167. Second, at the time of the alleged invention, POSITAs were working on clarifying a 5G UE's procedure for QCL assumption. Several companies actually proposed using the CORESET with the lowest ID amongst all "monitored" CORESETs, and then discussed these very proposals in a series of 3GPP meetings. *ZTE*, 12-13 ("Proposal 3"); *see also* Ex. 1016 ("*Nokia*"), 5 ("Issue 3.4"); Ex. 1017 ("*LG490*"), 5-6 ("Proposal 11"); *Intel*, 1-2 ("Proposal 4"). Thus, POSITAs were specifically motivated to improve the lowest-CORESET-ID rule of the then-existing 5G Standard and, as a result, would have considered *ZTE*'s proposed change as a beneficial solution in this regard.

168. Third, a POSITA would have appreciated that it was advantageous to apply *ZTE*'s improvement to *Guo*. As explained by *ZTE*, in applying the lowest-CORESET-ID rule, the UE needs to know the time parameters of the CORESETs to determine whether they are "in the latest slot." *ZTE*, 12-13; *Guo*, [0134]; *5G-Standard*, 26-27. But, as taught by *ZTE*, the relevant "time domain parameters … are included in the configuration of search space instead of CORESET," so the UE necessarily has to examine the search space configuration. *ZTE*, 12. Moreover, *ZTE* explains that there may exist non-monitored search spaces whose time domain parameters are unknown to the UE, in which case the UE would have difficulty in

ascertaining whether the CORESETs associated with these search spaces are located in the latest slot of the PDSCH. *ZTE*, 12. A POSITA would understand *ZTE*'s improvement avoids this difficulty. Therefore, a POSITA would have adopted *ZTE*'s improved rule focusing on only "monitored" CORESETs—i.e., that "the CORESET with the lowest CORESET-ID should be clarified as one CORESET associated with at least one search space set monitored by the UE." *ZTE*, 12.

b. Expectation of Success

169. A POSITA would have reasonably expected to succeed in modifying *Guo* with *ZTE*. *Guo* discloses a 5G UE and *ZTE* discloses an improvement to 5G. A POSITA modifying *Guo*'s UE would thus have had a high expectation that *ZTE*'s improvement would successfully work. Indeed, *ZTE*'s improvement was to the 5G Standard, which *Guo* discloses that its UE follows.

170. Moreover, a POSITA would know how to successfully configure a UE to include *ZTE*'s improvement. For example, the 5G Standard documents addressed how to configure UEs and CORESETs to implement *ZTE*'s improvement of obtaining CORESET IDs of monitored search spaces. Ex. 1021, *TS-38.331*, 238, 309. To configure *Guo*'s UE to examine, as taught by *ZTE*, the search space configuration and the association between the search space and CORESET ID, a POSITA would have understood that this was relatively

straightforward. Indeed, limiting the examination to only monitored CORESETs only requires a relatively minor software update that was well within the ordinary skills in the art before the time of the '896 patent. A POSITA would thus have appreciated that *Guo*'s UE, based on the received search space configuration, could know whether a CORESET ID is associated with a monitored search space and CORESET.

2. Independent Claim 10

a. [10Preamble]: "A user equipment (UE) comprising:"

171. [10Preamble] is the same as [1Preamble], which *Guo* discloses as discussed for [1Preamble]. *Supra*, Section XII.A.2.a.

b. [10a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

172. [10a] recites substantively the same limitations as [1a], which *Guo* discloses as discussed for [1a]. *Supra*, Section XII.A.2.b.

c. [10b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

173. [10b] recites substantively the same limitations as [1b], which *Guo* discloses as discussed for [1b]. *Supra*, Section XII.A.2.c.

d. [10c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot;"

174. [10c] recites substantively the same limitations as [1c], which *Guo* discloses as discussed for [1c]. *Supra*, Section XII.A.2.d.

e. [10d]: "receive Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from a Physical Downlink Control Channel (PDCCH); and"

175. In my opinion, *Guo* discloses [10d]. A 5G system receives DCI from a PDCCH to schedule the receipt of PDSCH. Indeed, *Guo* discloses that its UE will "receive[] PDCCH and decode a DCI" to "schedule[] PDSCH transmission." *Guo*, [0145], [0147]. This comported with the 5G Standard that *Guo*'s UE implemented. *5G-Standard*, 15 ("For a PDSCH scheduled with a DCI format 1_0 in any type of PDCCH…").

f. [10e]: "apply a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between an end of a last symbol of the PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"

176. In my opinion, *Guo* discloses and/or renders obvious [10e]. *Guo* discloses a way of determining the QCL for PDSCH:

> In one example, if the offset between reception of the DL DCI and the corresponding PDSCH is less than the

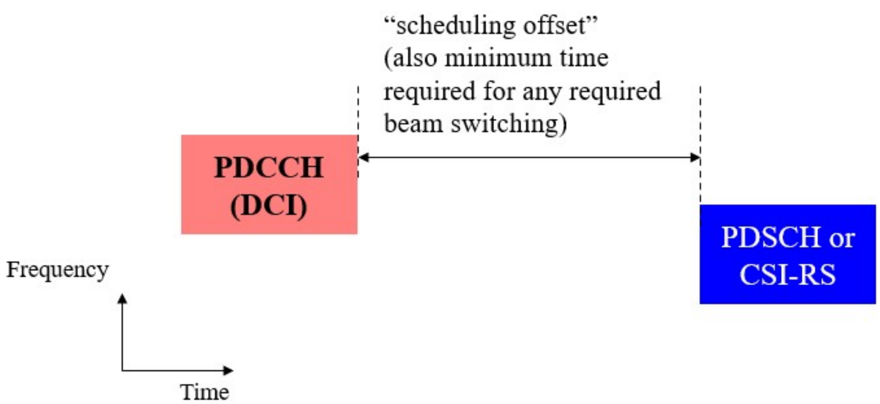
> threshold T, the UE may assume that the antenna ports of DMRS of PDSCH are quasi co-located based on the TCI state used for PDCCH quasi-co-location indication of the lowest CORESET ID in the latest slot where one or more CORESETs [are] configured for that UE.

Guo, [0134]. This discloses, consistent with the 5G Standard, the claimed "apply[ing] a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between … the PDCCH carrying the DCI and … the PDSCH is less than a threshold." As discussed for [10d], the claimed "PDCCH" is used to schedule the PDSCH. *Supra*, Section XII.B.2.e.

177. A POSITA would understand that *Guo*'s "PDCCH … of the lowest CORESET ID in the latest slot" would be used for scheduling the PDSCH, as this was common in 5G systems, particularly when the CORESET of the lowest CORESET ID is the only monitored CORESET. Particularly, *Guo* states that this PDCCH is transmitted "in the latest slot," so it is capable of scheduling the PDSCH. The lowest CORESET ID also means that the CORESET containing this PDCCH has the highest priority among all the CORESETs, which was commonly used in 5G systems to carry scheduling information for the PDSCH. Again, *Guo* comports with the 5G Standard. As *Guo* explains, since the PDCCH is "in the latest slot," it can be used to schedule the PDSCH. *Guo,* per the 5G Standard,

however, used the "lowest CORESET ID" of all CORESETs, regardless of whether monitored or not.

178. As to the claim language that the "scheduling offset" is between "an end of a last symbol" of the PDCCH and "a beginning of a first symbol" of the PDSCH, *Guo* effectively discloses this too, if not rendering this particular way obvious. *See supra*, XII.A.3.b (Ground 1, [2b]). Specifically, *Guo* further discloses that the scheduling offset "is the minimum time duration this UE needs between [scheduling] PDCCH and PDSCH so that this UE is able to decode the [scheduling] DCI and obtain the [QCL] carried in [the scheduling] DCI in time before the starting time of the transmission of the PDSCH." *Guo*, [0135]; *see also Guo*, [0125], [0136]. If the UE reported threshold is less than this minimum, then the UE cannot use the QCL assumption in the DCI used to schedule the PDSCH. *Guo*, [0126]-[0128]. The diagram below illustrates this.



179. Thus, as shown, the minimum time (i.e., scheduling offset) disclosed in *Guo* is between the end of the last symbol of the scheduling DCI and the beginning of the first symbol of the PDSCH. *Supra*, XII.A.3.b (Ground 1, [2b]).

g. [10f]: "wherein the PDCCH is transmitted in one of a set of one or more monitored CORESETs, and the one of the set of one or more monitored CORESETs is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

180. In my opinion, the *Guo/ZTE* combination renders obvious [10f]. As discussed in Section XII.B.1, *supra*, it would have been obvious to modify *Guo*'s QCL assumption—the lowest ID of all CORESETs (whether monitored or not)—to limit this to only the "monitored" CORESETs (i.e., a CORESET "*with at least one search space set monitored by UE*"). *ZTE*, 12-13.

181. To confirm, a POSITA would understand that a search space is part of every CORESET, such that a "monitored search space" refers to a CORESET that the UE "monitor[s]." The CORESET with a monitored search space, as disclosed in *ZTE*, thus corresponds to the claimed "one of a set of one or more monitored CORESETs," as recited in claim 10.

182. Moreover, as discussed for [10e] (*supra*, Section XII.B.2.f), if the CORESET with the "lowest" ID happened to be a "monitored" CORESET, a scenario that frequently occurred in 5G systems, then [10f] is met, as a result of this too.

183. That said, and as discussed above, *ZTE* discloses an improvement for *Guo*'s 5G UE, using only "monitored" CORESETs to determine the "lowest" ID when applying a QCL assumption for reception of the PDCCH to schedule receiving the PDSCH. And as discussed above in Section XII.B.1, *supra*, it would have been obvious to combine the teachings of *Guo* and *ZTE* to arrive at the claimed UE.

C. Ground 3: Claims 1-9 and 11-19 Are Rendered Obvious by *5G-Standard* in View of *Intel*

1. Rationale for Combining *5G-Standard* and *Intel*

184. *5G-Standard* is the 5G Standard that existed in September 2018. It was made available on 3GPP's FTP site[10] no later than October 1, 2018. Rodermund ¶¶31, 165-173. *5G-Standard* disclosed the use of the "lowest *CORESET-ID*" in the context of a default QCL assumption. *5G-Standard*, 26. It also disclosed:

> If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources … is smaller than the UE reported threshold[,] the UE applies a default QCL assumption [to receive the aperiodic CSI-RS resources].

[10] The 3rd Generation Partnership Project ("3GPP") is the standard-setting body for 5G or 5G-NR.

5G-Standard, 40. Almost simultaneously, *Intel*—a proposal discussed during a 3GPP meeting during October 8-12, 2018—proposed the following:

> The default beam for CSI-RS for CSI acquisition follows the TCI state in *monitoring* CORESET in active BWP in latest slot with lowest CORESET ID when multiple CORESETs are configured.

Intel, 1 (emphasis added); Rodermund ¶¶25, 109-117. In 5G, the TCI state contains information specifying the QCL assumption. *5G-Standard*, 26-27. So, *Intel*'s recommendation at the time was to use the QCL assumption of the "monitoring" CORESET with the "lowest CORESET ID" as the default QCL assumption for receiving aperiodic CSI-RS. As discussed below, a POSITA would have found it obvious to use *Intel*'s proposed method to determine the default QCL assumption contemplated by *5G-Standard* for receiving aperiodic CSI-RS.

a. Motivation to Combine

185. In my opinion, a POSITA would have been motivated to combine the teachings of *5G-Standard* and *Intel* for several reasons.

186. Both contemplate the same reasons to apply a default QCL assumption for receiving the aperiodic CSI-RS. *5G-Standard* discloses using the default QCL assumption when the scheduling offset between the PDCCH carrying the triggering DCI and the aperiodic CSI-RS is smaller than the UE reported threshold. *5G-Standard*, 40. Likewise, *Intel* discloses an improved way of determining the QCL default or default beam when the scheduling offset is smaller

than the threshold. *Intel*, 1. Thus, a POSITA would have readily appreciated that *Intel*'s 5G technique can be used to improve the *5G-Standard* itself.

187. *Intel* also concerns solving problems specifically in 5G. While *5G-Standard* contemplated a general QCL assumption for receiving the CSI-RS (*5G-Standard*, 40), *Intel* provides an improved way of determining this QCL assumption (*Intel*, 1). A POSITA thus would have been motivated to apply *Intel*'s teaching to *5G-Standard* that is ready for this improvement.

188. Moreover, a POSITA would have appreciated that *Intel*'s approach, as explained by *Intel* itself, is "better" because it allows using the CSI-RS to detect the channel condition for the PDSCH. *Intel*, 1. Additionally, *Intel* addresses the issue of which QCL assumption a UE should use to determine the default QCL, when multiple CORESETs occur. A POSITA would recognize the benefit of *Intel*'s approach because it would make the UE's determination more accurate.

189. Finally, a POSITA would have been motivated to improve *5G-Standard* with *Intel*'s technique for the reasons given in *Intel* itself and for the reasons provided to the 5G community. Both before and after the release of *5G-Standard*, members of the standardization working group submitted numerous proposals, each aimed at clarifying the way to apply the QCL assumptions. *See*, *e.g.*, *ZTE*, 12-13 ("Proposal 3"); Ex. 1016, *Nokia*, 5 ("Issue 3.4"); Ex. 1017, *LG490*, 5-6 ("Proposal 11"); Ex. 1026, *LG256*, 1-2 ("Proposal 3"); Ex. 1027,

CATT, 3 ("Proposal 3"). As a result, POSITAs would have found it obvious to implement *Intel*'s technique into *5G-Standard*. Indeed, it was *Intel*'s intent that its proposal should be incorporated into the 5G Standard.

190. In summary, a POSITA would have been motivated to incorporate *Intel*'s 5G proposal into *5G-Standard* itself to determine the default QCL assumption for receiving CSI-RS, as this would harvest the many benefits of *Intel*'s technique and resolve the challenges that had already been identified by the 5G community.

b. Expectation of Success

191. A POSITA would have had a reasonable expectation of success in combining *5G-Standard* and *Intel*, and would have expected this combination to yield a predictable solution. As discussed above, *5G-Standard* called for applying "a default QCL assumption" when the scheduling offset of the CSI-RS is less than a threshold, and *Intel* discloses what the "default QCL assumption" is. *5G-Standard*, 40; *Intel*, 1. As such, the combination requires nothing more than a direct incorporation of *Intel*'s teaching into *5G-Standard*.

192. A POSITA would also have had a reasonable expectation of success for implementing the resulting combination because it merely requires ordinary skill. Particularly, a POSITA could have configured the 5G UE to implement *Intel*'s added 5G functions by adding software that executes *Intel*'s proposed way

to determine the default QCL assumption because, again, this was well within the skill of the 5G art.

2. Independent Claim 1

a. [1Preamble]: "A user equipment (UE) comprising:"

193. In my opinion, *5G-Standard* discloses [1Preamble] as it describes procedures performed by a UE. *E.g.*, *5G-Standard*, 34-70 ("5.2 UE procedure for reporting channel state information (CSI)").

b. [1a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

194. In my opinion, *5G-Standard* discloses and/or renders obvious [1a]. UEs before the '896 patent, e.g., a pre-November-2018 cell phone, would have one or more non-transitory computer-readable media (e.g., ROM and RAM) storing instructions that, when executed, cause the UE to perform certain functions, e.g., wireless communications. *5G-Standard* was for such phones; so, at the very least, a POSITA would have understood that the UE described in *5G-Standard*, a "2018-09" 5G standard, would have computer-readable media having computer-executable instructions. *5G-Standard*, 1. Moreover, to the extent Patent Owner argues or the Board finds that *5G-Standard* does not already disclose [1a], a POSITA would have found it obvious to have the UE perform the procedure specified in *5G-Standard* by executing computer-executable instructions stored in

one or more non-transitory computer-readable media. And a POSITA would have had a reasonable expectation of success to do the above because it was well-known, conventional, and routine in the art before 2018.

c. [1b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

195. In my opinion, *5G-Standard* discloses and/or renders obvious [1b]. A POSITA would have understood the UE described in *5G-Standard* would also need to have at least one processor coupled to the computer-readable media, so as to execute the instructions on that media. *See*, *e.g.*, *Guo*, [0067], [0070]-[0071]. Moreover, to the extent Patent Owner argues or the Board finds that *5G-Standard* does not already disclose [1b], a POSITA would have found it obvious to perform the UE procedure specified in *5G-Standard* by using a processor coupled to the one or more non-transitory computer-readable media to execute the computer-executable instructions. A POSITA would have been motivated to do so because the above provides higher processing speed and improved user experiences. And a POSITA would have had a reasonable expectation of success because fast and powerful processing chips suitable for mobile phones were widely available before 2018.

d. [1c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and"

196. In my opinion, the *5G-Standard/Intel* combination renders obvious [1c]. *5G-Standard* discloses that "one or more CORESETs within the active BWP of the serving cell are configured for the UE" and "in the latest slot." *5G-Standard*, 26; *see also 5G-Standard*, 24-25. *Intel* discloses this too. *Intel*, 1 (disclosing "multiple CORESETs are configured" for a UE in a 5G system). *See also supra*, Section XII.A.2.d (explaining fundamental feature of 5G is that the UE monitors at least one CORESET in the active BWP).

197. Further, for at least the reasons discussed in Section XII.C.1, *supra*, it would have been obvious to combine the teachings of *5G-Standard* and *Intel* to have the UE receive an aperiodic CSI-RS using "the TCI state in monitoring CORESET in active BWP in latest slot with lowest CORESET ID when multiple CORESETs are configured." *Intel*, 1. Here, *Intel* teaches that multiple CORESETs can be configured for the UE, and at least one of them (the "CORESET … with lowest CORESET ID") is monitored by the UE in the active BWP in the latest slot. *Intel*, 1.

e. [1d]: "apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),"

198. In my opinion, the *5G-Standard/Intel* combination renders obvious [1d]. *Intel* teaches that "[t]he default beam for [receiving] CSI-RS for CSI acquisition follows the TCI state in monitoring CORESET in active BWP in latest slot with lowest CORESET ID." *Intel*, 1. Here, the "monitor[ed] CORESET … with lowest CORESET ID" discloses the claimed "first CORESET of a set of one or more monitored CORESETs." Moreover, *Intel*'s teaching of following the TCI state of the monitored CORESET discloses the claimed "apply[ing] a first Quasi Co-Location (QCL) assumption" because the TCI state refers to information including at least the claimed QCL assumption. *5G-Standard*, 26, 40. Finally, for at least the reasons discussed in Section XII.C.1, *supra*, it would have been obvious to combine the teachings of *5G-Standard* and *Intel*.

f. [1e]: "wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

199. In my opinion, the *5G-Standard/Intel* combination renders obvious [1e]. As discussed for [Ground 3, 1d], *5G-Standard/Intel*'s monitored CORESET with the lowest CORESET ID discloses the claimed "first CORESET." *Intel*, 1; *supra*, Section XII.C.2.e. Moreover, for the reasons in Section XII.A.2.f (Ground

1, [1e]), *supra*, a POSITA would readily understand that the monitored CORESET includes a monitored search space "configured with" a lowest CORESET ID, as claimed.

3. Claim 2

a. [2a]: "The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain, from the first CORESET, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS,"

200. The *5G-Standard/Intel* combination renders obvious [2a]. It was well known in 5G that aperiodic CSI-RS is scheduled by DCI in CORESETs. *Supra*, Section XII.A.3.a (Ground 1, 2[a]). Both *5G-Standard* and *Intel* refer to a "scheduling offset" between "the triggering DCI and … the aperiodic CSI-RS resources." *5G-Standard*, 40; *Intel*, 1. Moreover, as discussed for [1c] and [1d] (*supra* Sections XII.C.2.d, XII.C.2.e), *5G-Standard/Intel* teaches that the first CORESET is a "monitoring CORESET in active BWP in latest slot with lowest CORESET ID when multiple CORESETs are configured." *Intel*, 1; *see also supra*, Sections XII.A.2.d, XII.A.2.e (detailing the teachings of *Guo* that implements the 5G Standard). Since the monitored CORESET is in the latest slot, e.g., the slot containing the CSI-RS transmission or a slot before that, a POSITA would understand that the CORESET is monitored before the CSI-RS is received in time

and therefore would carry the scheduling DCI, such that the UE obtains that scheduling DCI from the monitored CORESET.

b. [2b] "wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold."

201. *5G-Standard* renders obvious, if not implicitly discloses, [2b] by disclosing that the default QCL assumption for CSI-RS is used "[i]f the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources … is smaller than the UE reported threshold." *5G-Standard*, 40; *see also supra*, Section XII.A.3.b (the "end of a last symbol" and the "beginning of a first symbol" were at least an obvious implementation of the 5G Standard, if not implicitly disclosed by the Standard itself—this comports with the Patent Owners own interpretation too).

202. As explained in Section XII.A.3.b, a POSITA would understand that the scheduling offset refers to the time window for the UE to switch its receiving beam for receiving the CSI-RS. *5G-Standard*, 40; *Intel*, 1. Because the UE cannot start the beam switching until after the end of the DCI duration and must complete the beam switching before the arrival of the CSI-RS, a POSITA would understand that the scheduling offset is the time window between the "end" of the last symbol of the scheduling DCI and the "beginning" of the first symbol of the CSI-RS. I

understand Patent Owner agrees with this. Patent Owner's own Complaint in the district court litigation relies on this same language within the 5G Standard as disclosing [2b]. Ex. 1040, Patent Owner's Complaint, ¶ 54.

4. Claim 3

a. "The UE of claim 1, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE."

203. For at least the same reasons discussed above with respect to claim 3 in Section XII.A.4, *supra*, the *5G-Standard*/*Intel* combination renders this claim obvious. This is particularly because the disclosure of *Guo* detailed in Section XII.A.4 comports with the 5G Standard.

5. Claim 4

a. "The UE of claim 3, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID."

204. For at least the same reasons discussed above with respect to claim 4 in Section XII.A.5, *supra*, the *5G-Standard*/*Intel* combination renders this claim

obvious. This is particularly because the disclosure of *Guo* detailed in Section XII.A.5 comports with the 5G Standard.

6. Claim 5

a. "The UE of claim 3, wherein the second CORESET is configured on one of: a deactivated Bandwidth Part (BWP); and a deactivated Secondary Cell (SCell)."

205. For at least the same reasons discussed above with respect to claim 5 in Section XII.A.6, *supra*, the *5G-Standard*/*Intel* combination renders this claim obvious. This is particularly because the disclosure of *Guo* detailed in Section XII.A.6 comports with the 5G Standard.

7. Claim 6

a. "The UE of claim 3, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain."

206. For at least the same reasons discussed above with respect to claim 6 in Section XII.A.7, *supra*, the *5G-Standard*/*Intel* combination renders this claim obvious. This is particularly because the disclosure of *Guo* detailed in Section XII.A.7 comports with the 5G Standard.

8. Claim 7

a. "The UE of claim 1, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell."

207. *5G-Standard/Intel* renders obvious claim 7. As discussed for [2a] in Section XII.C.3.a, *supra*, *Intel* teaches that multiple CORESETs are configured "in [the] latest slot," which would be the slot containing the CSI-RS transmission. Moreover, it is a fundamental feature of 5G that there is only one downlink BWP active in a UE at a given time, and the control information (e.g., CORESETs) and data (e.g., CSI-RS) are transmitted in an activated serving cell. Ex. 1018, *TS-38.211*, § 4.4.5; Ex. 1019, *TS-38.213*, 69. Therefore, a POSITA would understand that the plurality of CORESETs and the resource carrying the aperiodic CSI-RS are provided in the same time slot and the same active BWP of the serving cell. Moreover, for the reasons I explain above with respect to claim 7 in Ground 1, *supra* Section XII.A.8, *5G-Standard/Intel* renders this claim obvious – particularly because the disclosure of *Guo* detailed in Section XII.A.8 comports with the 5G Standard.

9. Claim 8

a. **[8a]: "The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first CORESET; and"**

b. **[8b]: "apply a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"**

c. **[8c]: "wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain."**

208. For at least the same reasons discussed above with respect to claim 8 in Section XII.A.9, *supra*, the *5G-Standard*/*Intel* combination renders this claim obvious. This is particularly because the disclosure of *Guo* detailed in Section XII.A.9 comports with the 5G Standard.

10. Claim 9

a. **"The UE of claim 8, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE."**

209. For at least the same reasons discussed above with respect to claim 9 in Section XII.A.10, *supra*, the *5G-Standard*/*Intel* combination renders this claim

obvious. This is particularly because the disclosure of *Guo* detailed in Section XII.A.10 comports with the 5G Standard.

11. Claims 11-19

210. Claims 11-19 are substantially the same as claims 1-9 discussed above. *Supra*, Sections XII.C.2-XII.C.10. The main difference concerns the preamble, with claims 1-9 being directed to a UE device configured to perform a "method," while claims 11-19 concern the "method" itself. Thus, for the same reasons I discuss above with respect to claims 1-9, the *5G-Standard* and *Intel* combination also renders obvious the method of claims 11-19. *Supra*, Sections XII.C.2-XII.C.10.

D. Ground 4: Claim 10 Is Rendered Obvious by *5G-Standard* in View of *ZTE*

1. Rationale for Combining *5G-Standard* and *ZTE*

211. As discussed above with respect to Ground 1, the then-existing 5G Standard disclosed that the UE would apply the QCL, for receiving the PDSCH, from the CORESET having the "lowest" ID amongst all CORESETs configured for that UE—not amongst only the "monitored" CORESETs, as claimed.

212. As explained, though, *ZTE* proposed this improvement to the 5G Standard itself. Specifically, *ZTE* proposed that the CORESET with the "lowest" CORESET ID should be a CORESET "***associated with at least one search space set monitored***" by the UE. *ZTE*, 12 (emphasis added). A POSITA would have thus

found it obvious to modify *Guo*'s 5G UE to include *ZTE*'s proposed improvement to 5G.

a. Motivation to Combine

213. In my opinion, a POSITA would have been motivated to combine the teachings of *5G-Standard* and *ZTE* for several reasons.

214. First, a POSITA would have appreciated that *ZTE*'s 5G improvement benefits *5G-Standard*. Indeed, at the time of the alleged invention, POSITAs had been working on clarifying 5G's procedure for QCL assumption done by a UE. Several companies had proposed modifying *5G-Standard* to include improvements consistent with *ZTE*. *See, e.g.*, Ex. 1016, *Nokia*, 5 ("Issue 3.4"); Ex. 1017, *LG490*, 5-6 ("Proposal 11"); *Intel*, 1-2 ("Proposal 4"). These improvements would have made a UE more accurate. Thus, POSITAs were specifically motivated to improve the lowest-CORESET-ID rule of *5G-Standard* and, as a result, would have considered *ZTE*'s proposed change as a beneficial solution in this regard.

215. Second, *5G-Standard* motivated POSITAs to apply *ZTE*'s teaching. Specifically, *5G-Standard* specified that "a default QCL assumption" would be used when "the scheduling offset … is smaller than the UE reported threshold." *5G-Standard*, 40. While *5G-Standard* does not specify this particular "default QCL assumption," *ZTE* explains this. *ZTE*, 12-13. For instance, *ZTE* proposes that the "monitored" CORESET with the "lowest" ID be used for the PDSCH. *ZTE*, 12-13.

A POSITA would thus have been motivated to apply *ZTE*'s 5G improvement to *Guo*'s 5G UE.

b. Expectation of Success

216. A POSITA would have reasonably expected to succeed in modifying *5G-Standard* with *ZTE*. Indeed, for *ZTE*'s improvement is directed to *5G-Standard* itself.

217. In this regard, a POSITA would know how to successfully configure a UE of *5G-Standard* to include *ZTE*'s improvement. Configuring such a UE to implement *ZTE*'s improvement would involve updating a CORESET's search space configuration and its association between the search space and CORESET ID—updates that a POSITA would have understood were relatively straightforward. Indeed, this only requires a relatively minor software update that was well within the ordinary skills in the art before the time of the '896 patent.

2. Independent Claim 10

a. [10Preamble]: "A user equipment (UE) comprising:"

218. In my opinion, *5G-Standard* discloses [10Preamble] for the same reasons I discuss above for [1Preamble]. *Supra*, Section XII.C.2.a ([1Preamble]).

b. [10a]: "one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and"

219. In my opinion, *5G-Standard* discloses and/or renders obvious [10a] for the same reasons I discuss above for [1a]. *Supra*, XII.C.2.b ([1a]).

c. [10b]: "at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:"

220. In my opinion, *5G-Standard* discloses and/or renders obvious [10b] for the same reasons I discuss above for [1b]. *Supra*, Section XII.C.2.c ([1b]).

d. [10c]: "monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot;"

221. In my opinion, *5G-Standard* discloses [10c]. First, *5G-Standard* discloses multiple CORESETs "configured for the UE." In *5G-Standard*, a UE can support up to twelve CORESETs. Ex. 1018, *TS-38.211*, § 4.4.5 ("A UE can be configured with up to four bandwidth parts in the downlink with a single downlink bandwidth part being active at a given time."); Ex. 1021, *TS-38.331*, 238 ("The network configures at most 3 CORESETs per BWP per cell (including UE-specific and common CORESETs).").

222. Second, *5G-Standard* discloses that the UE will "monitor" at least one CORESET "within an active [BWP] of a serving cell in a time slot," as claimed.

5G-Standard, 24. In 5G, when a UE monitors a CORESET, the "UE monitors a set of PDCCH candidates in one or more control resource sets on the active DL BWP on each activated serving cell" and there is "a single downlink [BWP] … active at a given time." Ex. 1018, *TS-38.211*, § 4.4.5; Ex. 1019, *TS-38.213*, 69.

e. [10d]: "receive Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from a Physical Downlink Control Channel (PDCCH); and"

223. In my opinion, *5G-Standard* discloses [10d]. In 5G, a UE necessarily receives DCI from a PDCCH to schedule the receipt of PDSCH. For example, *5G-Standard* discloses that its UE will receive PDCCH and decode a DCI to schedule PDSCH transmission. *5G-Standard*, 10.

f. [10e]: "apply a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between an end of a last symbol of the PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,"

224. In my opinion, *5G-Standard* discloses [10e]. *5G-Standard* discloses rules for determining the QCL "for reception of the PDCCH to receive the PDSCH" based on a "scheduling offset." With regard to the specific claim language that this known scheduling offset is specifically between "an end of a last symbol" of the PDCCH and the "beginning of a first symbol" of the PDSCH, this is an obvious specific implementation of the "scheduling offset" taught by *5G-*

Standard. *Supra*, XII.A.3.b (Ground 1, [2b]) (*5G-Standard*'s disclosure relevant to "end of a last symbol" and "beginning of a first symbol"); *see also supra*, Section XII.D.2.e (explaining "PDCCH" is used for scheduling the PDSCH).

g. [10f]: "wherein the PDCCH is transmitted in one of a set of one or more monitored CORESETs, and the one of the set of one or more monitored CORESETs is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs."

225. The *5G-Standard/ZTE* combination renders obvious [10f]. As I discuss in Section XII.D.1, *supra*, it would have been obvious to modify *5G-Standard*'s QCL assumption—the lowest ID of all CORESETs (whether monitored or not)—to limit this to only the "monitored" CORESETs (i.e., a CORESET "with at least one search space set monitored by UE"). *ZTE*, 12-13; *see also supra*, Section XII.A.2.f (explaining a monitored CORESET has a "monitored search space").

XIII. CONCLUSION

226. For the reasons set forth in Section XII, it is my opinion that one skilled in the art would have found claims 1-19 of the '896 patent obvious.

227. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

228. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: August 28, 2025

Respectfully submitted,

Harry Bims

Harry V. Bims, Ph.D.

Claims Listing

1. **[1Preamble]**[11] A user equipment (UE) comprising:

[1a] one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and

[1b] at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:

[1c] monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and

[1d] apply a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),

[1e] wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs.

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[11] I have added the bold brackets for ease of reference within the claims.

2. **[2a]** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to: obtain, from the first CORESET, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS,

   [2b] wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold.

3. The UE of claim 1, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

4. The UE of claim 3, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID.

5. The UE of claim 3, wherein the second CORESET is configured on one of:
a deactivated Bandwidth Part (BWP); and
a deactivated Secondary Cell (SCell).

6. The UE of claim 3, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain.

7. The UE of claim 1, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell.

8. **[8a]** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
obtain Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first CORESET; and
[8b] apply a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a

PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,

[8c] wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain.

9. The UE of claim 8, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

10. **[10Preamble]** A user equipment (UE) comprising:

[10a] one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and

[10b] at least one processor coupled to the one or more non-transitory computer-readable media, and configured to execute the computer-executable instructions to:

[10c] monitor at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot;

[10d] receive Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from a Physical Downlink Control Channel (PDCCH); and

[10e] apply a Quasi Co-Location (QCL) assumption for reception of the PDCCH to receive the PDSCH, when a scheduling offset between an end of a last symbol of the PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,

[10f] wherein the PDCCH is transmitted in one of a set of one or more monitored CORESETs, and the one of the set of one or more monitored CORESETs is associated with a monitored search space configured with a lowest CORESET Identity (ID) among the set of one or more monitored CORESETs.

11. **[11Preamble]** A method of wireless communications, the method comprising:

[11a] monitoring, by a user equipment (UE), at least one of a plurality of Control Resource Sets (CORESETs) configured for the UE within an active Bandwidth Part (BWP) of a serving cell in a time slot; and

[11b] applying, by the UE, a first Quasi Co-Location (QCL) assumption of a first CORESET of a set of one or more monitored CORESETs to receive an aperiodic Channel Status Information-Reference Signal (CSI-RS),

[11c] wherein the first CORESET is associated with a monitored search space configured with a lowest CORESET Identity (ID) among a set of one or more monitored CORESETs.

12. **[12a]** The method of claim 11, further comprising:

obtaining, by the UE, Downlink Control Information (DCI) scheduling the aperiodic CSI-RS from the first CORESET,

[12b] wherein a scheduling offset between an end of a last symbol of a Physical Downlink Control Channel (PDCCH) carrying the DCI and a beginning of a first symbol of a resource carrying the aperiodic CSI-RS is less than a threshold.

13. The method of claim 11, wherein the first CORESET overlaps a second CORESET of the plurality of CORESETs in at least one symbol in a time domain, the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.

14. The method of claim 13, wherein the monitored search space associated with the first CORESET is configured with a first search space ID, the non-monitored search space associated with the second CORESET is configured with a second search space ID, and the first search space ID is lower than the second search space ID.

15. The method of claim 13, wherein the second CORESET is configured on one of:

a deactivated Bandwidth Part (BWP); and

a deactivated Secondary Cell (SCell).

16. The method of claim 13, wherein the second CORESET further overlaps a third CORESET of the set of one or more monitored CORESETs in at least one symbol in the time domain.

17. The method of claim 11, wherein the plurality of CORESETs and a resource carrying the aperiodic CSI-RS are provided in the time slot and the active BWP of the serving cell.

18. **[18a]** The method of claim 11, further comprising:

obtaining, by the UE, Downlink Control Information (DCI) scheduling a Physical Downlink Shared Channel (PDSCH) from the first CORESET; and

[18b] applying, by the UE, a second QCL assumption of a second CORESET to receive the PDSCH when a scheduling offset between an end of a last symbol of a PDCCH carrying the DCI and a beginning of a first symbol of the PDSCH is less than a threshold,

[18c] wherein the second CORESET overlaps the PDSCH in at least one symbol in a time domain.

19. The method of claim 18, wherein the second CORESET is a non-monitored CORESET in the plurality of CORESETs, and the non-monitored CORESET is associated with a non-monitored search space configured to the UE.