

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS (“VERIZON”),
ERICSSON INC. (“ERICSSON”), NOKIA OF AMERICA CORPORATION
 (“NOKIA”), AT&T SERVICES, INC. (“AT&T”), GOOGLE LLC (“GOOGLE”),
AND T-MOBILE USA, INC. (“T-MOBILE”),
Petitioners

v.

KT CORPORATION (PATENT OWNER) AND PEGASUS WIRELESS
INNOVATION LLC (EXCLUSIVE LICENSEE),
Patent Owner.

U.S. PATENT NO. 11,405,942
Title: METHOD AND APPARATUS FOR TRANSMITTING AND
RECEIVING DOWNLINK SIGNAL IN NEXT GENERATION WIRELESS
NETWORK

Inter Partes Review No.: IPR2025-00317

**DECLARATION OF MARK R. LANNING IN SUPPORT OF PETITION
FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,405,942**

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Exhibit List

<i>Exhibit #</i>	<i>Description</i>
1001	U.S. Patent No. 11,405,942 (the “’942 Patent”)
1002	Select portions of prosecution history of the ’942 Patent (“File History”)
1003	Declaration of Petitioner’s Expert (“Lanning Declaration”)
1004	U.S. Publication No. 2017/0223687 A1 (“ <i>Kuchibhotla</i> ”), published August 3, 2017.
1005	U.S. Publication No. 2016/0234857 A1 (“ <i>Chen</i> ”), published August 11, 2016.
1006	3GPP TS 36.213 v8.8.0, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8), published September 2009
1007	3GPP TS 36.321 v8.7.0, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification, published September 2009
1008	3GPP TS 36.331 v8.7.0, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 8), published September 2009
1009	LTE in a Nutshell: The Physical Layer (White Paper), Telesystem Innovations Inc. (2010)
1010	U.S. Patent App. Pub. No. US 2019/0200235 A1 (“ <i>Lyu</i> ”), published June 27, 2019, and claiming priority to CN 201610654618.9 filed August 10, 2016
1011	U.S. Patent No. 10,397,938 B2 (“ <i>Lee</i> ”), issued August 27, 2019, and claiming priority to PCT/KR2015/01358 filed December 2, 2015
1012	U.S. Patent No. 8,995,925 B2 (“ <i>Ekici</i> ”), issued March 31, 2015
1013	U.S. Patent App. Pub. No. US 2007/0232308 A1 (“ <i>Bergstrom</i> ”), published October 4, 2007, published October 4, 2007
1014	U.S. Patent App. Pub. No. US 2013/0195100 A1 (“ <i>Baker</i> ”), published August 1, 2013

<i>Exhibit #</i>	<i>Description</i>
1015	U.S. Patent Publication No. 2018/0070341 A1 (“ <i>Islam</i> ”), published March 8, 2018, and claiming priority to September 2, 2016, September 16, 2016, and November 4, 2016
1016	3GPP TS 36.212 v8.7.0, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding (Release 8), published May 2009
1017	Newton’s Telecom Dictionary, 30 th Edition. November 2016.
1018	Mark R. Lanning’s CV.
1019	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 150
1020	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 68
1021	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 16
1022	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 178

***Expert Declaration of Mark R. Lanning In Support of
Petition for Inter Partes Review of U.S. Patent No. 11,405,942***

I. INTRODUCTION

1. My name is Mark R. Lanning, and I have been retained by the Petitioners to offer technical opinions relating to U.S. Patent No. 11,405,942 (“the ’942 Patent”) and prior art references relating to its subject matter. My extensive experience with cellular networks and their standards provides me with an understanding of the subject matter described and claimed in the ’942 Patent.

2. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the ’942 Patent. Any figures that appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the ’942 Patent and the prior art discussed below.

3. I have no financial interest in the party or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

4. I have extensive experience in the field of telecommunications including circuit-switched networks; multiple generations of cellular networks; and packet-switched networks.

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5. Further details on my education, work experience, and the cases in which I have previously given testimony in the past four years are contained in my curriculum vitae (CV). Ex. 1016.

6. I am currently the president of two consulting companies: Telecom Architects, Inc. and Reticle Consulting, LLC. Telecom Architects provides consulting services to fixed and wireless telecom service providers and their equipment suppliers. I have been President of Telecom Architects since 1999.

7. I have over 40 years of experience working in the telecommunications industry that began in the U.S. Army Signal Corp. My experience relevant to this case includes my work as an architect of various telecommunications systems and my work developing equipment used in telecommunications systems. This experience includes extensive design, implementation and testing work on the wireless interface functionality (between the base station and mobile phones) for multiple generations of cellular standards.

8. I received a B.S. in Computer Science from Southern Methodist University (SMU) in 1983.

9. DSC, now a part of Alcatel, hired me in 1983 where I was a software development manager on the team responsible for turning DSC's PSTN telephone switch into a Mobile Switching Center (MSC) for Motorola to sell as a part of their cellular product offering in the U.S. and many other countries.

10. In 1991, I began working as a consultant to Motorola for its “SuperCell” base station product and as a consultant to British Telecom to upgrade its current analog cellular network and I was one of the network architects responsible for the design and rollout of its Global System for Mobile Communications (GSM) network known as Cellnet. Beginning in the early 1990s, I was responsible for implementation of the SMS service, including working with suppliers of the SMS Center (SMSC), Mobile Switching Centers (MSCs) and cellular phones to define and roll out the functionality that was to be provided.

11. I was personally involved with Nokia, Ericsson, Motorola and other equipment suppliers in this effort.

12. Since 1995, I have also provided second generation (2G) and third generation (3G) Code Division Multiple Access (“CDMA”) network architecture and equipment design and implementation consulting services to companies such as Sprint, Nextel, Nokia, and Ericsson. While consulting to Nextel, which has since become part of Sprint, as one of the network architects for its iDEN network, one of my responsibilities was to define the network and mobile phone functionality required to support MMS and advanced data communications capability.

13. In addition to my cellular experience listed above, for at least the past ten years, I have kept up to date my knowledge of the present-day 3G, 4G, and 5G cellular network and wireless standards and their associated equipment and

protocols. I have done this through my study of each new release of these standards, technical books and trade publications as well as my expert work in legal cases, which has involved evaluating the functionality of many different types of network equipment, mobile devices, and baseband chipsets. I have also evaluated thousands of cellular technology patents and most of these were for cellular phone and/or base station functionality.

14. I am a member of the Institute of Electrical and Electronics Engineers (IEEE), including the IEEE Standards Association. I am also a member of the Association for Computing Machinery (ACM). While employed at DSC, I was a member of the ANSI T1 and T1X1 standard groups responsible for the definition and standardization of the Advanced Intelligent Network (AIN) and Signaling System 7 (SS7) protocol.

15. I was retained as a technical expert by Verizon Communications Inc., Cellco Partnership d/b/a Verizon Wireless, Verizon Business Network Services LLC, Verizon Corporate Services Group Inc., and TracFone Wireless, Inc., AT&T Inc., AT&T Corp., AT&T Services, Inc., AT&T Mobility LLC, AT&T Mobility II LLC, New Cingular Wireless PCS, LLC and Cricket Wireless LLC, T-Mobile US, Inc., T-Mobile USA, Inc., Sprint LLC, Sprint Solutions LLC, and Sprint Spectrum LLC, Ericsson, Inc. and Nokia of America Corporation. (collectively “Petitioners”).

III. DOCUMENTS AND OTHER MATERIALS REVIEWED

16. In forming the opinions set forth in this declaration, I have reviewed the documents Identified in the Exhibit List and the prosecution history of the '942 Patent and of the patents and patent applications to which it claims priority.

17. Additionally, I have utilized my own experience and expertise, including that regarding the knowledge and capabilities of a person of ordinary skill in the relevant art in the timeframe of the claimed priority date of the '942 Patent.

IV. UNDERSTANDING OF THE LAW

A. Date of Invention

18. I have been asked to use the date of November 16, 2016, as the date of invention for purposes of my analysis (the "Priority Date").

B. Obviousness

19. I am a technical expert and do not offer any legal opinions. However, counsel has informed me that in proceedings before the USPTO, claim terms are to be given the meaning they would have to a person having ordinary skill in the art at the time of the alleged invention ("POSITA"), taking into consideration the patent, its file history, and secondarily, any applicable extrinsic evidence (e.g., dictionary definitions).

20. I am informed by Counsel and understand that a patent claim is invalid under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time of the

invention to a person having ordinary skill in the art to which the subject matter pertains (“POSITA”). Obviousness, as has been explained to me, is based on (i) the scope and content of the prior art, (ii) the differences between the prior art and the claim, (iii) the level of ordinary skill in the art, and (iv) any secondary indicia of non-obviousness (e.g., “secondary considerations” such as commercial success in the marketplace of the claimed invention), to the extent that they exist.

21. I further understand that obviousness may be shown by showing that it would have been obvious to combine the teachings of more than one item of prior art. In determining whether a piece of prior art could have been combined with other prior art or with other information within the knowledge of a person having ordinary skill in the art, the following are examples of approaches and rationales that may be considered:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of a known technique to improve similar devices (methods, or products) in the same way;
- Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;

- Applying a technique or approach that would have been obvious to try (choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success);
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to a person having ordinary skill in the art; and
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

22. I further understand that an invention may be obvious if one of ordinary skill in the art, facing a wide range of needs created by developments in the field, would have seen an obvious benefit to the solutions tried by the applicant. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, it may be obvious to a person of ordinary skill to try the known options. If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique would have been obvious.

23. I further understand that a person of ordinary skill in the art is a hypothetical person who is presumed to be aware of all the relevant art at the time of the invention. The person of ordinary skill is not an automaton and may be able to fit together the teachings of multiple patents and/or printed publications

employing ordinary creativity and the common sense that familiar items may have uses in another context or beyond their primary purposes.

24. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists to avoid impermissibly applying hindsight when combining or modifying the prior art. I understand this test should not be applied rigidly, but that the test can be important to avoid such hindsight.

25. I also understand that one of ordinary skill in the art must have a reasonable expectation of success in combining or modifying prior art references.

26. I also understand that all elements of a claim must be considered in an obviousness analysis.

C. Standard of Proof

27. I understand that the standard to prove unpatentability in an *inter partes* review proceeding is by a preponderance of the evidence, which means more likely than not.

V. PERSON OF ORDINARY SKILL IN THE ART

28. I have considered the level of ordinary skill in the art relevant to the '942 Patent. I understand that factors such as the education level of those working in the field, the sophistication of the technology, the types of problems encountered

in the art, the prior art solutions to those problems, and the speed at which innovations are made may help establish the level of skill in the art.

29. After reviewing the '942 Patent, the relevant portions of the prosecution history of the '942 Patent, and cited references, it is my opinion that the relevant art of the '942 Patent is in the general field of wireless communication systems and more specifically it is focused on some of the functionality that, at the time, was envisioned for use and ultimately used in post Long Term Evolution (LTE) 4G and in 5G NR cellular networks. *See e.g.*, Ex. 1001, Abstract.

30. Specifically, the '942 Patent relates to supporting effective multiplexing between data traffic having mutually different QoS requirements. Ex. 1001, Abstract. The '942 Patent additionally describes these QoS requirements as:

An enhanced mobile broadband (eMBB), massive machine-type communication (mMTC), and ultra-reliable and low latency communication (URLLC) are proposed as representative usage scenarios of the NR. Ex. 1001, 1:43-46.

In order to satisfy requirements of such usage scenarios, it is necessary to satisfy various requirements of a per-usage scenario basis first. For example, the URLLC is required to satisfy quick data transmission/reception compared with the eMBB. *Id.* 1:50-54.

31. Based upon my knowledge of this field, I conclude that a POSITA at the time of the alleged invention of the '942 Patent, and for that matter, at all

subsequent times through the present, would have been familiar with wireless communications networks, equipment, and integrated circuit chips, and would have had at least a working knowledge of the communication protocols issued by 3GPP. A POSITA would have had a bachelor's degree in electrical engineering, computer engineering, or a related discipline, knowledge of the relevant 3GPP standards as of this time, and at least 2 years of experience working in a field involving wireless communications. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. A person with less than 2 years of experience working in a field involving wireless communications could still qualify if the person has additional education that compensates for their lesser experience.

32. I am and was at the time of the alleged invention, at least a person of skill in the relevant art, of a level at least as high as or more than ordinarily skilled persons, and I can provide insight and opinions into the understandings of such persons at all relevant times by virtue of my education, training, and experience.

VI. RELEVANT TECHNOLOGY BACKGROUND

A. The 3GPP Standards Organization

33. The 3GPP is a standards-setting organization. As cellular telecommunications technology developed in the late 1980s, network operators recognized that standardization was necessary to ensure subscriber mobility and

compatibility of equipment provided from multiple suppliers. Thus, the 3GPP began in 1998 when the European Telecommunications Standards Institute (ETSI) and other standard development organizations as well as several telecommunications companies formed a partnership to develop and standardize various aspects of 2G, 3G, and 4G mobile network operator systems.

34. The 3GPP is a group enterprise. Within the larger 3GPP umbrella are four primary plenary Technical Specification Groups (“TSGs”) (*e.g.*, the Systems and Architecture (“SA”) group), under which are several working groups (*e.g.*, Systems and Architecture Working Group 2 (“SA-2” or “S2”)). The meetings for each plenary and working group are numbered sequentially (*e.g.*, TSG RAN WG1, Meeting #40; TSG RAN WG1, Meeting #41).¹ In my experience, the working groups met roughly every month in the September 2016 timeframe and were responsible for drafting and editing specific standards and change requests. All change requests had to be approved by the plenary group before the change requests were incorporated into a specific release of the standard.

35. Major changes to the 3GPP standard are defined in “**Releases**,” which comprise many Technical Specifications (TS) and in my experience certain groups of releases are informally referred to as a “**generation**.”

¹ RAN stands for Radio Access Network.

36. Standardization by the 3GPP at the time of the '942 Patent was a collaborative effort and remains so today regarding new generations and Releases. It involves hundreds of engineers from companies that are interested in developing the technology. Each 3GPP working group typically holds monthly meetings in different locations around the world. The members of the working group submit written contributions (called “temporary documents” or “Tdocs”) and discussion documents. In my experience, the 3GPP stores and controls documents electronically, and these documents are retained on the public 3GPP server for many years.

B. The 3GPP 4G LTE Network Standard

37. The 3GPP LTE (4G) cellular standard was not based on a greenfield model. Instead, the LTE standard adopted many of the proven concepts that were known and used by millions of mobile terminals (UEs) in its predecessor 3G UMTS network. UMTS networks are still in operation today in the U.S. and many mobile terminals (UEs) can switch to 3G UMTS cells when they are in areas where LTE coverage is very weak or absent.

C. The 3GPP 5G NR Network Standard

38. Like the 4G LTE network standard, the 5G NR (New Radio) standard has been developed using many of the 4G LTE functions. As the “NR” in its name

implies modifications to the 4G LTE Radio Access Network (RAN) have been made in order to meet the design objectives of the 3GPP 5G network.

D. State of the Art

39. The following section describes the relevant state of the art as of the Priority Date, the identified prior art references, and what was known to a POSITA in order to assist in understanding how a POSITA would have understood the prior art, and provide the motivation to modify or combine the teachings of references.

1. The PDCCH Channel and Blind Decoding

40. By November 2016, the terminology and acronyms used in the '942 Patent were well-known to a POSITA. That terminology includes the Physical Downlink Control CHannel (PDCCH), which is a well-known type of channel used in wireless communication systems that had been defined by the 3rd Generation Partnership Project (3GPP) in global technical specifications many years before. For example, the 3GPP had defined the PDCCH and its functionality for 4G LTE in 2009. EX-1006 (36.213) e.g., pp. 7, 19-25, 53-56 and 66 and EX-1009 pp. 11-1211-1211-12.

41. The PDCCH is a common downlink physical channel that is monitored by the UEs that are attached to a base station. The PDCCH does not use dedicated space assignments for each UE, which would be very inefficient. Instead, each UE is responsible for monitoring the PDCCH, receiving the messages being sent and

decoding them to determine if it is the intended recipient. Using this method, the available PDCCH capacity is only used to send messages to active UEs. EX-1006 (36.213) e.g., p. 66 and EX-1009 pp. 11-12.

42. The area allocated to the PDCCH (number of Resource Elements—REs) the UE needs to monitor can vary from cell to cell based on the base station’s bandwidth allocation. For at least this reason, the base station informs the UE of the total size of the PDCCH area and the specific control areas it needs to monitor in order to find its messages. These PDCCH search spaces are designated by the base station as either a “common” search space or a “UE-specific” search space. EX-1006 (36.213) p. 66. The common search space is monitored by a group of UEs in a cell, while the UE-specific search space is only monitored by the specific UE it has been allocated to by the base station. This requirement is stated in at least the passage below from a 3GPP LTE specification:

The UE shall monitor one common search space at each of the aggregation levels 4 and 8 and one UE-specific search space at each of the aggregation levels 1, 2, 4, 8. The common and UE-specific search spaces may overlap.

See id. p. 64 (highlighting added)

43. The following table shows, *inter alia*: 1) the PDCCH search spaces are divided into UE-specific and Common areas; and 2) the messages transmitted on a PDCCH can be different lengths dependent on the type of information they carry so the longer messages require more Control Channel Elements (CCEs) to carry the information.

Table 9.1.1-1: PDCCH candidates monitored by a UE.

Type	Search space $S_k^{(L)}$		Number of PDCCH candidates $M^{(L)}$
	Aggregation level L	Size [in CCEs]	
UE-specific	1	6	6
	2	12	6
	4	8	2
	8	16	2
Common	4	16	4
	8	16	2

See id. at 65 (highlighting added).

44. The base station transmits this information to a UE using Downlink Control Information (DCI) messages via the RRC (Radio Resource Control) communication protocol . There are multiple formats defined for the DCI messages that are used for different purposes.

45. The process of the UE using the PDCCH configuration information sent to it in an RRC DCI configuration message in order for it to monitor the different PDCCH channels and allocation areas for messages and decoding them is referred to as “blind decoding.”

2. Blind Decoding of a PDCCH Using an RNTI

46. Blind Decoding of the PDCCH was routinely used in LTE 4G wireless communication systems years prior to 2016. The UE is required to perform Blind Decoding because it is not aware of the detailed control channel structure. It is the process of the UE monitoring a set of PDCCH candidates in order to find the messages being transmitted from the base station and, once it finds a message, it

needs to determine if the message is intended for it and not another UE. This process is referred to as being “blind” because these messages can typically be in one of multiple possible locations on one or more PDCCHs that the UE needs to search. As I describe above, these possible locations can consist of an area designated as a common search space that can be monitored by multiple UEs and/or a UE-specific area that is designated to a specific UE. These messages do not include the UE’s digital address in the header that the UE can use for comparison like many other communication protocols for other systems. Because the base station can send control messages to many UEs on one or more PDCCHs, a UE may need to detect multiple messages being transmitted on the PDCCH and perform the decoding of each message before it locates a message intended for it. In some cases, a UE will not find a message for its RNTI(s) during a specific timeframe (e.g., subframe), so it will repeat its monitoring during the next timeframe.

47. In order to keep the PDCCH control channel messages as short and as efficient as possible, each message includes a Cyclic Redundancy Check (CRC) field that is used for two purposes. First, the CRC value for each message is generated by the base station based on the value of the bits in the message so the UE can determine if any of the message bits have been corrupted during the transmission. Second, the CRC value is encoded (scrambled) by the base station using a special 16-bit code referred to as a **Radio Network Temporary Identifier (RNTI)** that the

base station has selected and informed the UE it would be using, prior to sending the message. This scrambling process is also referred to as “masking” the message with the RNTI. There are multiple types of RNTI codes that are used by the base station based on the purpose of the message being sent.

48. This CRC encoding and its subsequent scrambling with an RNTI value was described in the 4G LTE specification many years before the '942 Patent Priority Date.

Release 8	56	3GPP TS 36.212 V8.7.0 (2009-05)
5.3.3.2 CRC attachment		
Error detection is provided on DCI transmissions through a Cyclic Redundancy Check (CRC).		
The entire PDCCH payload is used to calculate the CRC parity bits. Denote the bits of the PDCCH payload by $a_0, a_1, a_2, a_3, \dots, a_{A-1}$, and the parity bits by $p_0, p_1, p_2, p_3, \dots, p_{L-1}$. A is the PDCCH payload size and L is the number of parity bits.		
The parity bits are computed and attached according to subclause 5.1.1 setting L to 16 bits, resulting in the sequence $b_0, b_1, b_2, b_3, \dots, b_{B-1}$, where $B = A + L$.		
In the case where UE transmit antenna selection is not configured or applicable, after attachment, the CRC parity bits are scrambled with the corresponding RNTI $x_{rnti,0}, x_{rnti,1}, \dots, x_{rnti,15}$, where $x_{rnti,0}$ corresponds to the MSB of the RNTI, to form the sequence of bits $c_0, c_1, c_2, c_3, \dots, c_{B-1}$. The relation between c_k and b_k is:		
$c_k = b_k \quad \text{for } k = 0, 1, 2, \dots, A-1$ $c_k = (b_k + x_{rnti,k-A}) \bmod 2 \quad \text{for } k = A, A+1, A+2, \dots, A+15.$		

EX-1016 (36.212), p. 56 (highlighting added).

49. Multiple passages from 3GPP 4G LTE specifications exemplify the well-known “blind decoding” process using an assigned RNTI value to descramble the CRC of a received message. *E.g.*, EX-1006 (36.213) p. 20 (“If a UE is configured by higher layers to decode PDCCH with CRC scrambled by the C-RNTI,

the UE shall decode the PDCCH and any corresponding PDSCH according to the respective combinations defined in table 7.1-5. The scrambling initialization of PDSCH corresponding to these PDCCHs is by C-RNTI.”) and p. 66 (“The UE shall monitor a set of PDCCH candidates for control information in every non-DRX subframe, where monitoring implies attempting to decode each of the PDCCHs in the set”).

50. This well-known “blind decoding” process, including the use of RNTIs to perform the decoding, also is described in numerous prior art references. For example, *Lyu* (EX-1010), which was cited during prosecution of the ’942 Patent, is directed to a preemption detection technique in a wireless communication network. In *Lyu*’s technique, a

downlink control channel that is **scrambled by the RNTI** and that indicates the data channel puncturing information may use the same number of information bits ... to reduce a quantity of blind detection times of the [UE]”).

EX-1010, ¶26 (emphasis added)².

51. Similarly, *Lee* (EX-1011), which also addresses preemption techniques, explains:

In 3GPP LTE, blind decoding is used to detect a PDCCH. Blind

² All emphasis and highlighting has been added by me unless otherwise noted.

decoding is a process of **de-masking a cyclic redundancy check (CRC)** of a received PDCCH (PDCCH candidate) with a desired identifier to check a CRC error, thereby allowing a UE to identify whether the PDCCH is a control channel of the UE.

EX-1011, 28:63-29:1 (emphasis added).

52. *Lee* further discloses an embodiment in which “**a new RNTI** (e.g., FG-RNTI) for a UE **to perform a blind decoding** of a fast UL grant may be defined.” EX-1011, 36:66-67 (emphasis added). *Lee*’s FG-RNTI is an example of a special RNTI that can be assigned to a UE for a specific purpose.

53. Consistent with the art, the ’942 Patent describes “monitoring” of control channels in the context of this well-known “blind decoding” process:

Meanwhile, the UE may perform monitoring in a **blind decoding** manner. For example, the UE may perform monitoring by performing **CRC scrambling of DL control information** including DL preemption indication information using a **cell-specific radio network temporary identifier (RNTI)**. For example, the cell-specific RNTI may be configured through cell-specific high layer signaling, or configured in advance with a pre-configured value. For another example, **the UE may perform monitoring by performing CRC scrambling of DL control information including DL preemption indication information using a C-RNTI** or a newly defined RNTI. For example, **the C-RNTI** or the newly defined RNTI may be received through **UE-specific RRC signaling**.

EX-1001, 10:66–11:12 (emphasis added).

3. UE-Specific / Dedicated Mode RRC Signaling

54. Like the PDCCH described above, (Radio Resource Control) RRC signaling functionality was defined no later than in 4G LTE Release 8 in 2009—long before the '942 Patent. RRC signaling is comprised of many different layer 3 protocol messages and is used to communicate many different types of control information and some data between a base station (BS) and a mobile terminal or User Equipment (UE). The RRC DCI messages (described above) can be addressed to multiple UEs or to a specific UE. When an RRC DCI message is being sent to a specific UE, it is referred to as UE-specific signaling (also dedicated signaling). One of the RRC DCI messages that has been in use since the beginning of 4G LTE, is a UE-specific message that defines configuration parameters for the UE. For example, the LTE RRC specification defines a procedure for a UE receiving a UE-specific (or dedicated) DCI message that contains a specific Information Element (IE). EX-1008 (36.331), pp. 34, 47, 48, 119 (“The IE *PhysicalConfigDedicated* is used to specify the UE specific physical channel configuration.”). The following shows the contents of the *PhysicalConfigDedicated* Information Element that is sent in a RRC protocol DCI message from the base station to the UE.

– **PhysicalConfigDedicated**

The IE **PhysicalConfigDedicated** is used to specify the **UE specific physical channel configuration**.

PhysicalConfigDedicated information element

```
-- ASN1START
PhysicalConfigDedicated ::=
SEQUENCE {
  pdsch-ConfigDedicated      PDSCH-ConfigDedicated      OPTIONAL,      -- Need ON
  pucch-ConfigDedicated      PUCCH-ConfigDedicated      OPTIONAL,      -- Need ON
  pusoch-ConfigDedicated      PUSCH-ConfigDedicated      OPTIONAL,      -- Need ON
  uplinkPowerControlDedicated UplinkPowerControlDedicated OPTIONAL,      -- Need ON
  tpc-PDCCH-ConfigPUCCH      TPC-PDCCH-Config          OPTIONAL,      -- Need ON
  tpc-PDCCH-ConfigPUSCH      TPC-PDCCH-Config          OPTIONAL,      -- Need ON
  cqi-ReportConfig           CQI-ReportConfig           OPTIONAL,      -- Need ON
  soundingRS-UL-ConfigDedicated SoundingRS-UL-ConfigDedicated OPTIONAL,      -- Need ON
  antennaInfo                CHOICE {
    explicitValue            AntennaInfoDedicated,
    defaultValue            NULL
  } OPTIONAL,      -- Need ON
  schedulingRequestConfig     SchedulingRequestConfig     OPTIONAL,      -- Need ON
  ...
}
-- ASN1STOP
```

EX-1008 (36.331), p. 119 (highlighting added).

55. Consistent with the 3GPP specifications, it was routine in the art to refer to UE-specific signaling as “dedicated” signaling. *See, e.g.,* EX-1012 (*Ekici*), 5:48-50 (in the context of a 3G network, describing “mobile network 100 may additionally or alternatively provide UE-specific control information in **dedicated messages (i.e. non-broadcast messages)** sent to mobile station(s)”); EX-1013 (*Bergstrom*), ¶14 (in the context of a multimedia broadcast multicast service, if UEs “listen to a channel that does not allow them to receive the common MBMS control channel message the [Radio Network Controller] will send the session start indication on a **per UE basis (i.e. in dedicated mode)**.”); EX-1014 (*Baker*), ¶¶50, 58 (in the context of an LTE network, describing “signaling may be broadcast, or **UE-specific (dedicated)**”; and “if the request for resources ... may be associated with a

configuration of the carrier for the UE, the transmission type or mode may be a **dedicated mode** along with the carrier configuration signaling information for the UE to detect the carrier (e.g., during a UE logon).”).

4. Common Search Space / Multicast Signaling

56. In addition to UE-specific (i.e., dedicated mode) signaling, the use of multicast signaling also was well-known and routinely used long before the '942 Patent. As I explained above, the base station sends messages to a UE through either a UE-specific search space or a common search space. The base station is understood to use dedicated signaling for the UE-specific search space because the messages are directed to a specific UE. When sending messages through a common search space, the base station is understood to use multicast signaling because the messages are from one base station to potentially many UEs, i.e., the group of UEs that are configured to receive messages through the common search space. That is, all the UEs monitoring the common search space would receive the message from the base station. However, as discussed above, only the UEs that have been configured with the correct RNTI value will be able to decode the message.

57. A commonly used telecommunications dictionary—Newton’s Telecom Dictionary—exemplifies that this understanding of a multicast as being a message sent from a base station for receipt by a common group of UEs was well-known as of the '942 Patent’s Priority Date. That is, one of the definitions for multicast

provided by Newton's Telecom Dictionary is "Multicast is communication between a single device and multiple members of a device group." EX-1017, p. 846.

58. Multiple references in the art also demonstrate that the transmission of signals to a common group of devices (i.e., a multicast) through a common search space, including signals indicating preempted resources, was well-known and commonly practiced as of the Priority Date. For example, *Islam*, which was cited during the prosecution of the '942 Patent, relates to "accommodat[ing] the presence of both low latency and latency tolerant communications in shared time-frequency resources to try to improve resource utilization." EX-1015, ¶6. *Islam* teaches sending control signaling "in any known manner" containing update information that

indicates to the UE with [latency tolerant] traffic that some or all of the time frequency resources originally scheduled for [latency tolerant] traffic have been punctured.

EX-1015, ¶68. *Islam* further discloses:

Control signaling containing **update information** can be UE specific or **group-common** and is transmitted / monitored by the UE after the aforementioned duration elapses at a configured search space. Common indication can be transmitted in **group-common DCI** such as in **common PDCCH**, or PCFICH or PHICH.

EX-1015, ¶68 (emphases added). According to *Islam*, a benefit of sending the update information is that "the UE with [latency tolerant] traffic can decode its

received transmission without considering the punctured regions, thereby potentially reducing decoding errors.” EX-1015, ¶68.

59. *Islam* discloses several examples of sending update information and teaches that it “can be sent as a **common signal** to at least the UEs whose transmission overlaps the [time-frequency] region.” EX-1015, ¶73 (emphasis added). According to *Islam*:

In some embodiments, the update information is information specifically for the UEs with [latency tolerant] traffic indicating some of their time-frequency resources are punctured. This implies that **update information can be sent to [a] group of UEs.**

EX-1015, ¶75 (emphasis added).

60. As another example, *Lyu*, also cited during prosecution, discloses that data channel puncturing information is sent in “**a common search space**” in a downlink control channel or to the group of “**all terminals transmitting data in a punctured data channel.**” EX-1010, ¶¶21, 22, 24 (emphases added). Consistent with the art’s understanding of a multicast, the Examiner understood this disclosure to be a disclosure of information being sent as *a multicast signal*. EX-1002, 416-417 (Prosecution History, Final Office Action dated 10/20/2021, pp. 2-3). That is, as discussed above, it was well-understood in the art that messages transmitted in

the “common search space” are a multicast because all the UEs monitoring this search space will receive the message.

61. Further, the use of a “common search space” in a downlink control channel had been defined years before the Priority Date of the ’942 Patent in the 4G LTE standard. As described above in Section VI.D.1, the 4G LTE standard defines two different types of search spaces that are allocated by the base station on the PDCCH. These are a common search space that is allocated to multiple UEs in a cell and a UE-specific search space that is allocated for a specific UE.

62. The 4G LTE standard also defined different transmission modes and DCI messages that a UE would need to monitor for in the different types of PDCCH search spaces. As described by the text and shown by the table below, the base station can send the DCI message formats highlighted in blue in either the common search space or a UE-specific search space. For these formats, the UE needs to monitor both the common and its UE-specific search space for these messages. For the DCI formats highlighted in red, the UE will only need to monitor its assigned UE-specific search space. Therefore, the 4G LTE standard differentiated between messages that are sent through a UE-specific search space of the PDCCH for receipt by a specific UE (i.e., unicast signaling) and messages that are sent through a common search space for receipt by one or more UEs configured to monitor the

common search area of the PDCCH. When the DCI message is masked with an RNTI that has been assigned to more than one UE, it is multicast signaling.

If a UE is configured by higher layers to decode PDCCH with CRC scrambled by the C-RNTI, the UE shall decode the PDCCH and any corresponding PDSCH according to the respective combinations defined in table 7.1-5. The scrambling initialization of PDSCH corresponding to these PDCCHs is by C-RNTI.

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Table 7.1-5: PDCCH and PDSCH configured by C-RNTI

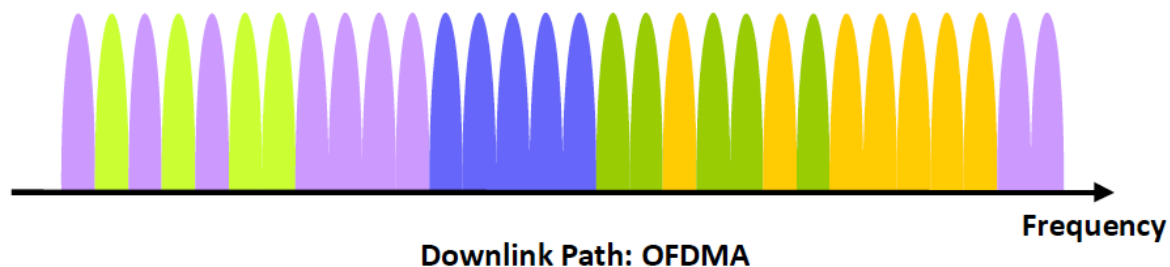
Transmission mode	DCI format	Search Space	Transmission scheme of PDSCH corresponding to PDCCH
Mode 1	DCI format 1A	Common and UE specific by C-RNTI	Single-antenna port, port 0 (see subclause 7.1.1)
	DCI format 1	UE specific by C-RNTI	Single-antenna port, port 0 (see subclause 7.1.1)
Mode 2	DCI format 1A	Common and UE specific by C-RNTI	Transmit diversity (see subclause 7.1.2)
	DCI format 1	UE specific by C-RNTI	Transmit diversity (see subclause 7.1.2)
Mode 3	DCI format 1A	Common and UE specific by C-RNTI	Transmit diversity (see subclause 7.1.2)
	DCI format 2A	UE specific by C-RNTI	Large delay CDD (see subclause 7.1.3) or Transmit diversity (see subclause 7.1.2)
Mode 4	DCI format 1A	Common and UE specific by C-RNTI	Transmit diversity (see subclause 7.1.2)
	DCI format 2	UE specific by C-RNTI	Closed-loop spatial multiplexing (see subclause 7.1.4) or Transmit diversity (see subclause 7.1.2)
Mode 5	DCI format 1A	Common and UE specific by C-RNTI	Transmit diversity (see subclause 7.1.2)
	DCI format 1D	UE specific by C-RNTI	Multi-user MIMO (see subclause 7.1.5)
Mode 6	DCI format 1A	Common and UE specific by C-RNTI	Transmit diversity (see subclause 7.1.2)
	DCI format 1B	UE specific by C-RNTI	Closed-loop spatial multiplexing (see subclause 7.1.4) using a single transmission layer
Mode 7	DCI format 1A	Common and UE specific by C-RNTI	If the number of PBCH antenna ports is one, Single-antenna port, port 0 is used (see subclause 7.1.1), otherwise Transmit diversity (see subclause 7.1.2)
	DCI format 1	UE specific by C-RNTI	Single-antenna port; port 5 (see subclause 7.1.1)

EX-1006 (36.213) p. 21 (highlighting added)

5. Information Related to Time and Frequency

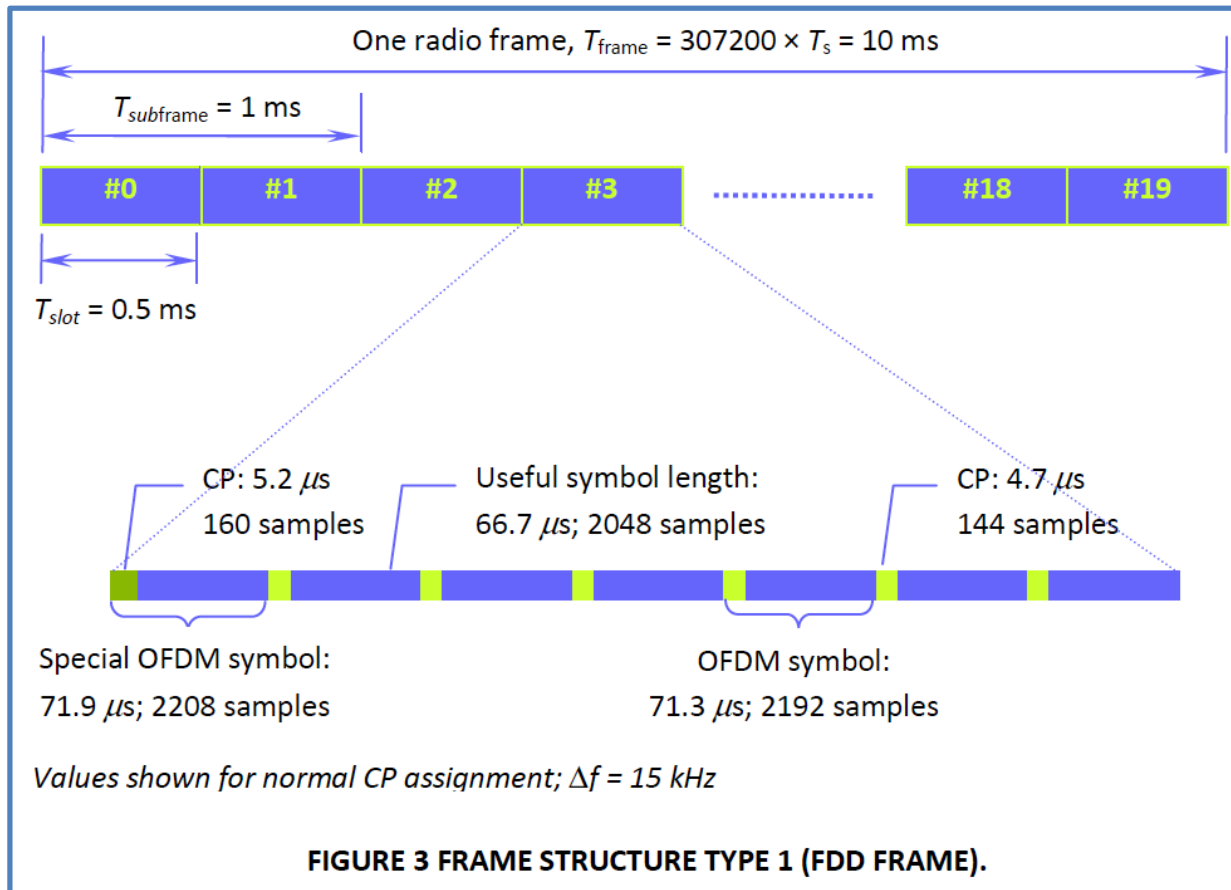
63. Wireless communication systems, including 4G LTE, use the radio technique referred to as OFDMA (orthogonal frequency-division multiple access)

on the downlink, which has both a frequency component and a time component. According to the OFDMA technique, the data transmitted from the base station to a UE is not transmitted on one large frequency band, but is divided up into many subcarriers that are transmitted to a UE on separate frequencies. This is the frequency component in OFDMA. EX-1009, p. 4. The diagram below shows the subcarrier frequencies in an OFDMA transmission.



Id.

64. Each of the subcarriers being transmitted at different frequencies as shown above is also divided up into different time intervals, where the largest time interval is a frame. A frame is further divided up into subframes and each subframe is divided up into two slots. Therefore, each subcarrier includes a frame with 20 slots that can be used to carry information to the UE. This is the time component of an LTE OFDMA downlink as shown in the diagram below.

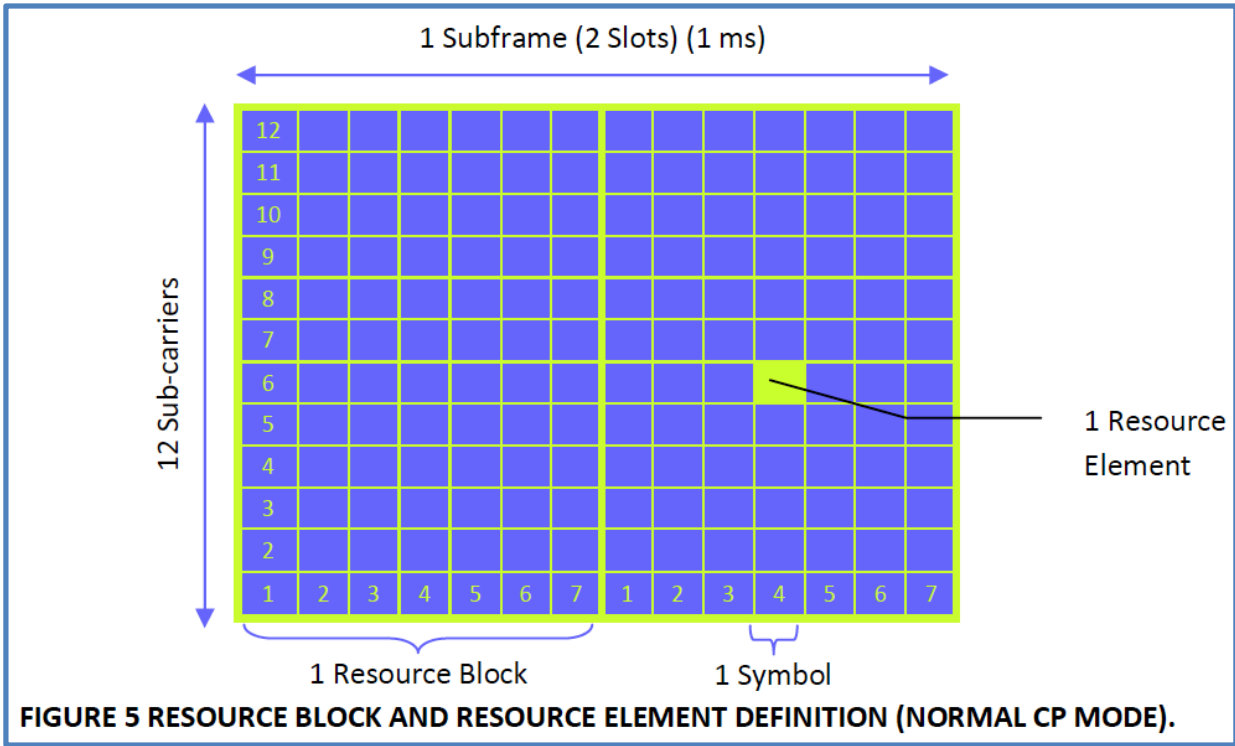


EX-1009, p. 5.

65. For the BS to communicate with the UE, the UE needs to know the time and frequency coordinates allocated for the transmission, e.g., it needs to know the frequency of the subcarrier and the time of the subframe/slot. The time and frequency coordinates are referred to as a “Resource.” The BS informs the UE of the Resource allocation in a configuration message.

66. The smallest unit of a Resource that can be used to transfer information between the BS and UE is referred to as a “Resource Element.” The term “OFDM symbol” also is commonly used, which represents a time period across multiple subcarrier frequencies. EX-1009, p. 6.

67. The diagram below represents both the frequency and time components of an OFDMA signal. The location of each Resource Element is represented by a frequency (sub-carrier number) and time coordinate (subframe, slot and symbol).



EX-1009, p. 6.

VII. OVERVIEW OF THE '942 PATENT

A. Summary of the Disclosure of the '942 Patent

68. The Challenged Claims are directed to (1) notifying a user equipment (UE) in a wireless communication system that certain radio resources have been preempted for another use, and (2) configuring the UE to monitor for the preemption notification information. A UE is configured via UE-Specific RRC protocol

signaling to monitor a DL control channel for the preemption notification information.

69. Although the '942 Patent describes exemplary usage scenarios in the context of a “study item” for “next-generation/5G radio access technology,” neither the specification nor the Challenged Claims are limited to a particular type of usage scenario or a particular generation of a wireless communication system. EX-1001, 1:31-33.

70. Preemption can be used in wireless communication systems for the purpose of concurrently supporting different usage scenarios that have different transmission/reception requirements. As an example of how usage scenarios can differ in their transmission/reception requirements, an enhanced mobile broadband (eMBB) service that is typically used for transmission of user data generally requires longer time-domain resources for providing a service to many users, while an ultra reliable low latency service (URLLC) typically used for a VoIP (Voice over Internet Protocol) type connection requires shorter time-domain resources to provide low latency. EX-1001, 1:31-62.

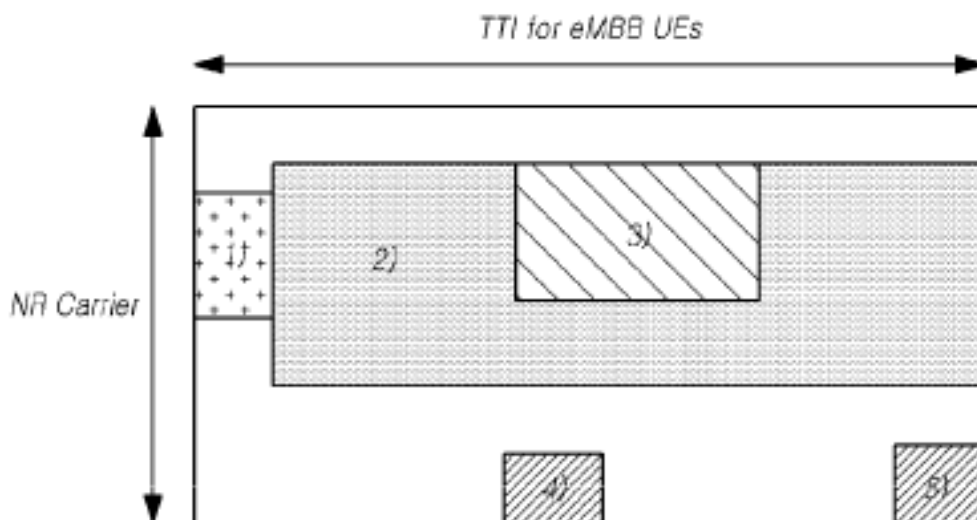
71. The '942 Patent recognizes that one way of allocating radio resources in a communication system that supports different services would be to semi-statically allocate resources for each usage scenario. EX-1001, 7:51-56. However, a semi-static method may not be efficient. For example, if a cell has sparse low

latency traffic, it may not be efficient to exclusively allocate resources for that usage scenario. EX-1001, 7:57-63.

72. Thus, the '942 Patent discloses techniques for dynamically using the scheduling resources of other services whenever traffic with low latency requirements is present. EX-1001 7:64-67. That is, resources originally scheduled for services that are not latency-sensitive can be dynamically pre-empted or re-allocated to low latency traffic when it occurs. EX-1001, 8:1-7.

73. To support this preemption-based scheduling of resources method, the '942 Patent discloses techniques that include notifying a user equipment (UE) if radio resources allocated for different types of traffic overlap each other, or if radio resources originally allocated to a service having sparse traffic are re-allocated to other services. EX-1001, 10:29-35. The notification techniques employ what the '942 Patent refers to as "DL [downlink] preemption indication information," which can be sent to the UE either before preemption has occurred (i.e., "pre-notification") or after pre-emption has already occurred (i.e., "post-notification"). EX-1001, 8:8-19. This DL preemption indication information can include information indicating radio resources that have been re-allocated for another service, radio resources for providing different services that overlap each other, and/or radio resources that are configured for a pre-configured service. EX-1001, 8:62-9:9, 10:29-35, 11:15-23.

74. FIG. 2 included below illustrates a method for transmitting DL preemption indication information to a UE through a pre-notification method or a post-notification method.



EX-1001, FIG. 2.

75. Figure 2 shows a Time Transmission Interval (TTI) that is being used for the UEs receiving an eMBB transmission. EX-1001, 6:36-37, 9:49-52. Region “1)” in FIG. 2 is a region for transmitting a DL control channel (PDCCH) to a first UE, which can include scheduling information for a DL data channel (PDSCH) for the first UE. Region “2)” is the region for transmitting the DL data channel to the first UE. Region “3)” is a region in which a second UE can transmit [sic: receive] a DL control channel (PDCCH) or DL data channel (PDSCH) through a preempted resource, when DL preemption occurs. EX-1001, 9:53-67.

76. If the pre-notification method is used, DL preemption indication information is transmitted to the first UE in region “4).” For the post-notification method, DL preemption indication information is transmitted to the first UE in region “5)” after preemption has occurred. EX-1001, 10:1-8.

77. The UE receives the DL preemption indication information from the base station through either a multicast signal or a unicast signal. EX-1001, 11:13-15, 12:1-4. For example, the DL preemption indication information may be received through a common search space or a group search space of a DL control channel (i.e., a multicast message/signal sent by the base station to many UEs monitoring the common search space of the DL control channel (e.g., PDCCH)). Alternatively, the DL preemption indication information may be transmitted by the base station via UE-specific search space of a DL control channel (i.e., a unicast message/signal sent by the base station using UE-specific signaling). EX-1001, 11:24-32, 12:13-25.

78. The '942 Patent discloses that the UE is configured to monitor for the DL preemption indication information based on configuration information that the UE has received from the base station through UE-specific radio resource control (RRC) signaling. EX-1001, 10:38-50. For example, the UE can use the configuration information to determine a radio resource or a search space to monitor for the DL preemption indication information, such as a DL control channel or a common search space, a group common search space or a UE-specific search space

of a DL control channel. EX-1001, 10:51-65. Further, the UE can monitor for DL preemption indication information in a “blind decoding” manner, which entails performing cyclic redundancy check (CRC) scrambling of information received in the control channel or search space using a radio network temporary identifier (RNTI) that the BS has sent to the UE in the UE-specific RRC configuration message. EX-1001, 10:66-11:12, 14:1-8, 15:30-37.

79. These general concepts—notifying a UE of resources preempted for another use and configuring the UE to monitor for the notification—are recited in the Challenged Claims, without regard to a particular type or generation of wireless communication network or any specific usage scenario or service.

B. The Challenged Claims

80. I understand the Petitioners are challenging claims 1-3, 5-7, and 9-11 of the '942 Patent (the “Challenged Claims”).

C. Prosecution History

81. The '942 Patent issued from U.S. Patent Application No. 16/349,874, which was filed on May 14, 2019, as a National Stage Entry of PCT/KR2017/012992 filed November 16, 2017, which claims foreign priority to KR 10-2016-152659, filed November 16, 2016 and KR 10-2017-0151983, filed November 15, 2017. EX-1001, cover page; 17:15-23.

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82. Based on my experience of reviewing hundreds of patents, the prosecution of the '942 Patent was extensive, as the claims were repeatedly rejected and amended.

83. In a non-final rejection dated June 29, 2021, the Examiner rejected the independent claims as being obvious in view of U.S. Patent Publication No. 2019/0200235 to Lyu et al. ("*Lyu*") (EX-1010) in view of U.S. Patent Publication No. 2018/0070341 to Islam et al. ("*Islam*") (EX-1015), U.S. Patent Publication No. 2018/0035332 to Agiwal et al. ("*Agiwal*");

Claims 1, 3, 4, 6, 8, 9, 11, 13, and 14 is/are rejected under 35 U.S.C. 103 as being unpatentable over Lyu et al. (US 2019/0200235) in view of Islam et al. (US 2018/0070341) and Agiwal et al. (US 2018/0035332).

For Claims 1 and 11, Lyu teaches a method of receiving a downlink (DL) signal by a first user equipment (UE), and a first user equipment (UE), comprising a receiver and a controller (see Figure 5 and paragraphs 121-123: receiver, processor, controller), for receiving a downlink (DL) signal, the method comprising:

receiving, by the first UE, configuration information including an RNTI for DL preemption indication information (see abstract, paragraph 55, Figure 2 step S101 and paragraph 61: terminal receives indication information indicating need to receive pre-emption information; see paragraphs 93-95: RNTI identifies that DCI is used to send DL preemption indication information);

monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the configuration information (see paragraphs 21, 87); and

receiving, by the first UE, the DL preemption indication information through a multicast signal (see paragraphs 21, 22: in common search space; paragraph 24: sent to all terminals).

EX-1002, 376 (Non-Final Rejection dated 06/29/2021, p. 4) (highlighted).

84. In response to the rejection, the Applicant amended the claims³ as follows:

1. (Currently Amended) A method of receiving a downlink (DL) signal by a first user equipment (UE), the method comprising:

receiving, by the first UE, ~~configuration information including~~ a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling;

after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI ~~included in the configuration information;~~ and

receiving, by the first UE, the DL preemption indication information through a multicast signal,

wherein the specific RNTI received through the UE specific RRC signaling is a newly defined RNTI other than ~~different from~~ at least a cell-RNTI (C-RNTI), and ~~the specific RNTI is a dedicated RNTI for monitoring the DL preemption indication information, and~~

wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received.

EX-1002, 397 (Amendment dated 09/21/2021, p. 2). The Applicant's arguments did not challenge the Examiner's assertions with respect to *Lyu, Islam*, and *Agiwal*,

³ Each of the independent claims was amended in the same manner. EX-1002, 397-401.

including the Examiner's assertion that *Lyu* discloses "receiving, by the first UE, the DL preemption indication information through a multicast signal." EX-1002, 403-408 (Amendment dated 09/21/2021, pp. 8-13).

85. The claims (including the independent claims) were then finally rejected as obvious over *Lyu*, *Islam*, and Agiwal and further in view of U.S. Patent Publication No. 2019/0021085 to Mochizuki et al. ("Mochizuki"); claims 2, 7 and 12 as obvious in *Lyu*, *Islam*, Agiwal, Mochizuki and further in view of U.S. Patent Publication No. 2019/0116007 to Yi et al. ("Yi"); and claims 21-26 in view of *Lyu*, *Islam*, Agiwal, Mochizuki and further in view of U.S. Patent Publication No. 2018/0020441 to Lo ("Lo"). EX-1002 416-421 (Final Rejection dated 10/20/2021, pp. 2-7).

86. To overcome the rejection, the Applicant amended each of the independent claims to further require:

wherein the specific RNTI is received with information related to time and frequency,
and
wherein the information related to time and frequency is received for the reception of the
DL preemption indication information.

EX-1002 450, 452-53 (Request for Continued Examination (RCE) dated 12/08/2021, pp. 2, 4, 5).

87. The Applicant distinguished the independent claims on the basis that "the specific RNTI, and information related to time and frequency are received

together. Both the specific RNTI, and information related to time and frequency information are used for receiving of the DL preemption indication information.”

EX-1002 __ (RCE dated 12/08/2021, pp. 9-10) (emphasis original). The Applicant argued that the prior art does not teach that “the information related to time and frequency is received for the reception of the DL preemption indication information.” EX-1002 458-59 (RCE dated 12/08/2021, pp. 10-11) (emphasis in original).

88. In the last rejection before allowance, the independent claims were rejected as obvious over Agiwal in view of U.S. Patent Publication No. 2019/02881609 to Kowalski et al. (“Kowalski”). EX-1002 464 (Non-Final Rejection dated 02/11/2022, p. 2).

89. In response, the Applicant amended the last limitation of each of the independent claims to add that the information related to time and frequency is received “through the UE-specific RRC signaling.” EX-1002 493 (Amendment dated 05/02/2022, p. 2). The Applicant argued that this “novel feature” – “the information related to time and frequency is transmitted through the UE specific RRC singling [sic]” – differentiated the claims from the prior art. EX-1002 502 (Amendment dated 05/02/2022, p. 11) (emphasis in original).

90. A Notice of Allowance was then issued allowing 12 claims including the 3 independent claims. The Notice of Allowance did not provide a Reason for Allowance. EX-1002 508-10 (Notice of Allowance dated 06/02/2022).

91. All Challenged Claims require the limitations the Applicant relied on for patentability, namely:

- the information related to time and frequency is received for the reception of the DL preemption indication information; and
- transmitting the time and frequency information through UE-specific RRC signaling.

D. Claim Construction

92. I understand that Petitioners propose that each claim term be given its plain and ordinary meaning herein. The prior art herein meets each claim limitation under any reasonable construction.

VIII. IDENTIFICATION OF CHALLENGES

93. I understand the Petitioners are making the following Challenges:

Ground	Claims	Basis	Reference(s)
1	1-3, 5-7, and 9-11	§ 103	<i>Kuchibhotla</i> , in view of the knowledge of a POSITA
2	1-3, 5-7, and 9-11	§ 103	<i>Kuchibhotla</i> in view of <i>Chen</i> , and further in view of the knowledge of a POSITA

IX. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. The Challenged Claims are Unpatentable over the Prior Art Cited Herein

94. Ground 1 is that *Kuchibhotla* in view of the knowledge of a POSITA renders the Challenged Claims obvious.

95. Ground 2 is that *Kuchibhotla* in view of *Chen* and further in view of the knowledge of a POSITA renders the Challenged Claims obvious.

1. Overview of *Kuchibhotla*

96. United States Publication No. 2017/0223687A1 to Kuchibhotla et al. (EX-1004) (“*Kuchibhotla*”) was filed February 2, 2016, as Application No. 15/013,014 and published on August 3, 2017, and I understand that it qualifies as prior art under 35 U.S.C. § 102(a)(2).

97. Like the '942 Patent, *Kuchibhotla* is directed to techniques and apparatus to support latency sensitive traffic types and other latency sensitive use cases while at the same time supporting regular latency transmissions. EX-1004, ¶¶6-7, 41. These techniques include re-allocating resources assigned for regular latency traffic to low latency traffic when it occurs, and notifying a UE of the re-allocation by providing a marker in a downlink control channel. These techniques also include using UE-specific higher layer signaling (e.g., dedicated mode RRC signaling) to configure a UE to monitor for the marker. The higher layer signaling includes time-frequency information identifying radio resources for receiving the

marker and a special RNTI assigned to the UE for use to blindly monitor for the control channel and/or the marker. The marker, which includes information identifying the preempted resources, can be sent after preemption has occurred. As illustrated below, these are the same features that are required by the Challenged Claims, including the features that the Applicant argued were “novel” during prosecution.

98. FIG. 12 illustrates the operation of a UE in a system that accommodates transmission of low latency and regular latency data in the same subframe.

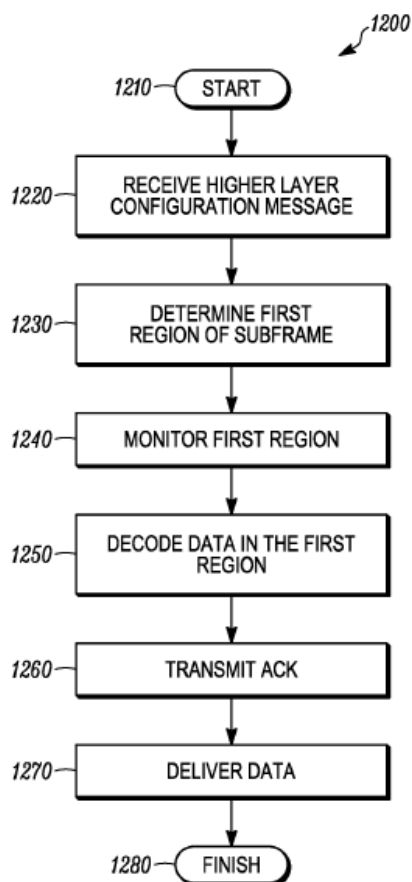


FIG. 12

EX-1004, FIG. 21.

99. *Kuchibhotla* discloses that, at step 1220, the UE receives a higher layer configuration message, which can be a dedicated mode radio resource control (RRC) message sent to the UE. EX-1004, ¶¶57, 104. At step 1230, the UE determines a first region of a subframe for receiving data packets based on the RRC configuration message. EX-1004, ¶¶57, 105. For example, the configuration message can identify a control region including physical downlink control channel (PDCCH) candidates that the UE can attempt to receive low latency data on, including a marker. EX-1004, ¶¶57, 58, 83, 105, 127, 131.

100. At step 1240, the UE monitors the first region (which includes PDCCH candidates). Monitoring can include attempting to decode the information in the first region, including by blind decoding. EX-1004, ¶¶57, 107.

101. At step 1250, the UE implements blind decoding of low latency PDCCH (e.g., LL-PDCCH) candidates based on a unique identifier corresponding to the UE that is assigned by the serving BS in the higher layer configuration message. In addition to the cell RNTI (C-RNTI) normally assigned to each UE when it initially connects to the base station, the UE also can be assigned special RNTIs for various purposes. EX-1004, ¶¶47, 84, 108.

102. Disclosed examples of special RNTIs are a Semi-Persistent-Scheduling C-RNTI (SPS C-RNTI), a temporary C-RNTI (TC-RNTI), a low latency RNTI (LL-

RNTI) that is applied as a CRC mask to decode an LL-PDCCH, and a marker-RNTI that is applied as a CRC mask to decode a “marker transmission” in a PDCCH. EX-1004, ¶¶47, 84.

103. Because both regular latency and low latency transmissions can be sent in the same subframe, the BS transmits the marker to indicate which resources are used in the subframe for low latency transmission. The BS can send the marker to the UE in a transmission common to multiple UEs. The possible locations of the marker can be indicated to the UE via the higher layer (e.g., RRC) configuration signaling. EX-1004, ¶¶76, 82, 83.

104. FIG. 15 illustrates operation of a BS for signaling the existence and/or the location of low latency data transmissions. EX-1004, ¶126.

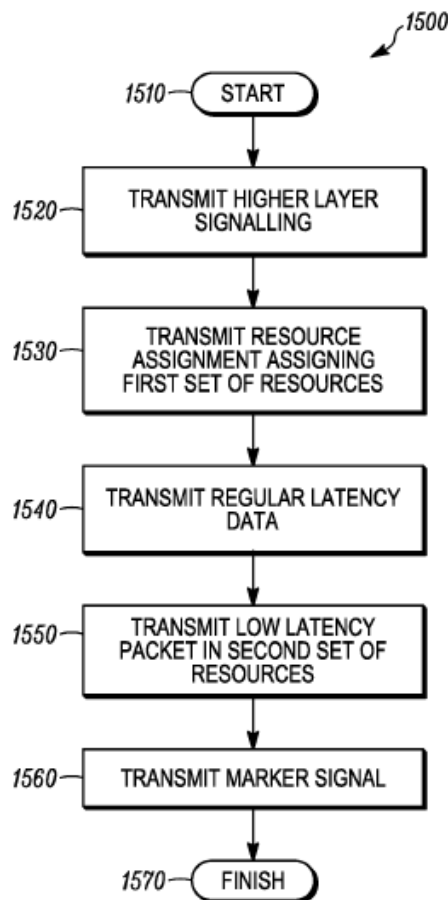


FIG. 15

EX-1004, FIG. 15.

105. *Kuchibhotla* discloses that, at step 1520, the higher layer signaling can be transmitted to a UE by the BS in a subframe. “The higher layer signaling can indicate a set of OFDM symbols where low latency data may be transmitted, a set of resource blocks where low latency data may be transmitted, a set of OFDM symbols where marker signal may be transmitted, and/or a set of resource elements where marker signal may be transmitted.” EX-1004, ¶127. At step 1530, the BS

sends the UE a resource assignment that assigns a first set of time-frequency resources in a subframe for regular latency transmissions. EX-1004, ¶128. At steps 1540 and 1550, regular latency and low latency transmission occurs. Low latency data can be transmitted in a second set of time-frequency resources in the same subframe as the regular latency data, and the second set can at least partially overlap with the first set of resources. EX-1004, ¶130.

106. At step 1560, the BS transmits a marker to indicate presence of low latency data in the subframe. The marker is transmitted in one of the candidate marker locations indicated by the higher layer signaling, such as a control channel in a subframe following the subframe in which the low latency transmission occurred. EX-1004, ¶131. The marker can be sent as a “broadcast transmission common to multiple devices.” EX-1004, ¶76.

107. FIG. 21 illustrates transmission of a marker in a control channel (PDCCH) in a subframe immediately following the low latency transmission.

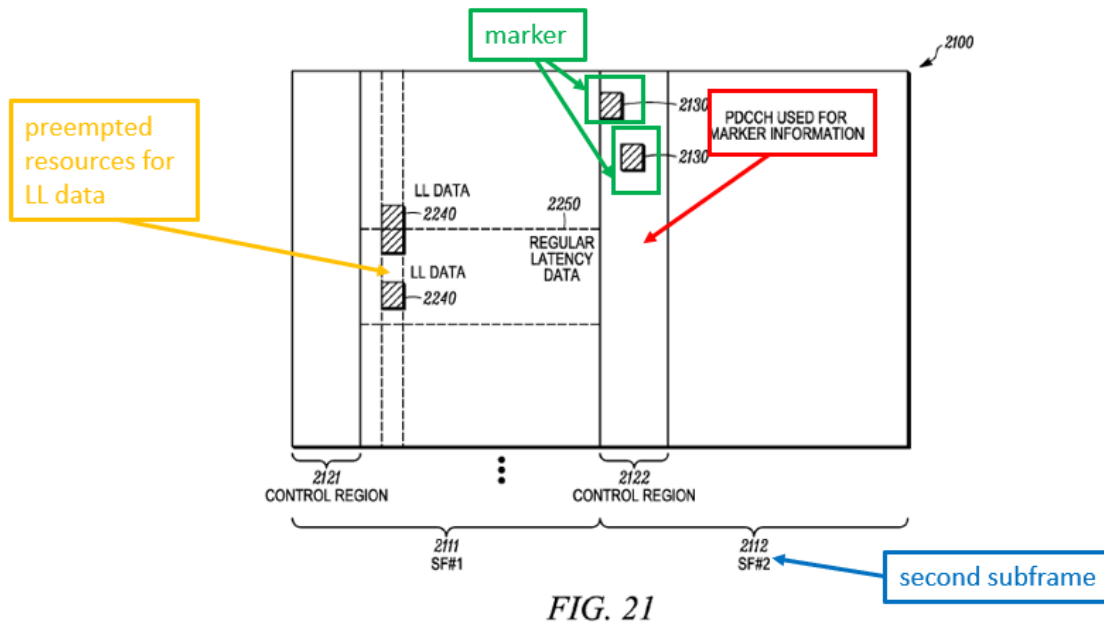


FIG. 21

EX-1004, FIG. 21 (annotated).

108. The first subframe 2111 includes control region 2121, low latency data 2240 and regular latency data region 2250. The second subframe 2112 includes control region 2122 which includes marker 2130. The marker 2130 indicates the resources used for low latency transmission in the previous subframe 2111. Subframe 2112 is transmitted immediately after subframe 2111. When the PDCCH is used for marker transmission, the marker can be differentiated from other control channel transmissions by using a special CRC mask to decode the marker (i.e., marker-RNTI). EX-1004, ¶84.

2. Overview of *Chen*

109. United States Publication No. 2016/0234857 A1 to Chen et al. (EX-1005) (“*Chen*”) was filed January 12, 2016, as Application No. 14/993,592 and published on August 11, 2016, and I understand that it qualifies as prior art under 35 U.S.C. § 102(a)(2).

110. Like the ’942 Patent and *Kuchibhotla*, *Chen* is directed to a wireless communication network that supports low latency and non-latency sensitive transmissions in the same subframe. EX-1005, Abstract, ¶6. *Chen* teaches:

In some cases, the low latency transmission may puncture the resources allocated to the non-low latency transmission, which may tend to cause interference for the first UE 115. ... This may result in decoding failures
....

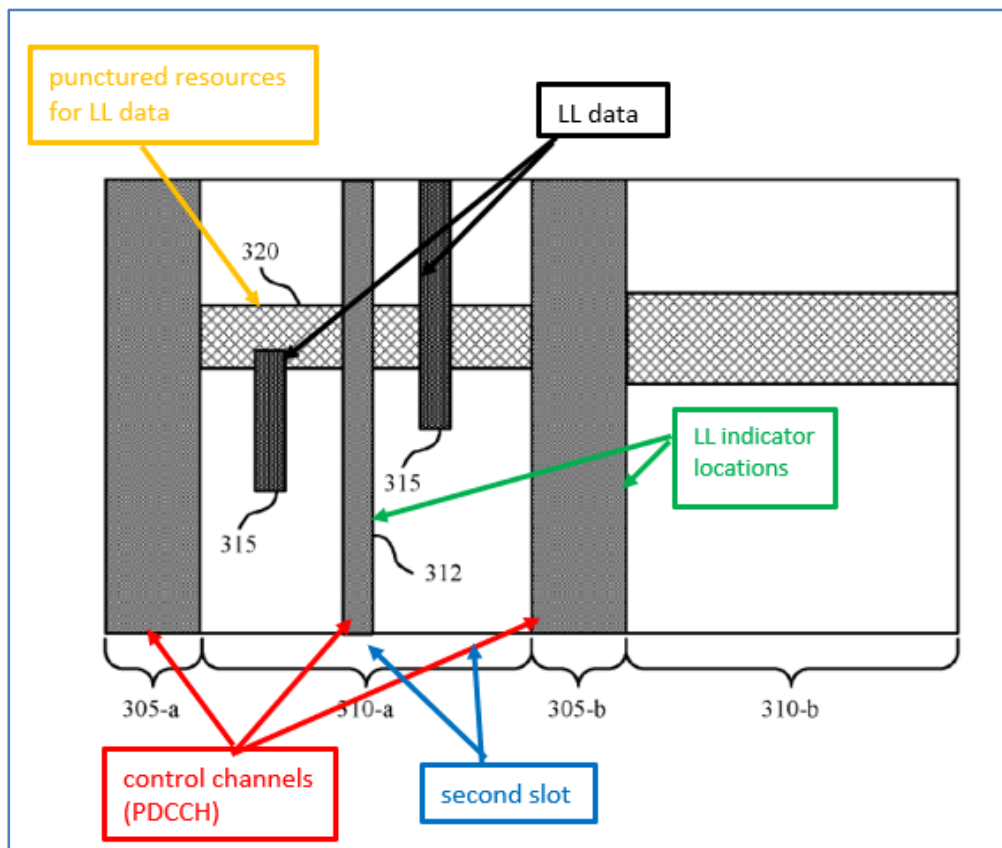
EX-1005, ¶57.

111. To address the problem caused by resource puncturing, *Chen* discloses that the BS generates an indicator that informs the UE where and when low latency communications are occurring. EX-1005, ¶58. *Chen* further discloses:

the indicator may be included as part of a PDCCH transmitted in the first symbol period of the next subframe. ... In some cases, the indicator may be sent in symbols that include broadcast-type or multicast-type content.

EX-1005, ¶62.

112. FIG. 3 illustrates a channel structure 300 of a transmission between a BS and UEs that includes control regions 305-a, 305-b, control channel 312, and data regions 310-a and 310-b. Regions 305-a and 310-a make up a first non-latency TTI; regions 305-b and 310-b make up a second non-latency TTI. The non-latency TTIs can be “subframes that include two slots.” Region 320 is a physical downlink shared channel (PDSCH). EX-1005, ¶71. In other words, the whole of Fig. 3 below is showing two non-latency TTIs that are also referred to as non-latency sub-frames. Each of these non-latency TTIs/sub-frames includes two slots.



EX-1005, FIG. 3 (annotated)

113. *Chen* discloses:

Low latency transmission 315 may **puncture the PDSCH 320** ... The base station 105 may therefore include a **low latency indicator** at some point after the **low latency transmission 315**—e.g., the **low latency indicator** may be ... in the subsequent control region 305-b. In some examples, a **control channel 312** at the beginning of **slot 1**, within the first data region 310-a may **indicate** a low latency transmission 315 in **slot 0**. . . . For instance, **control channel 312** may represent broadcast-type or multicast-type information that includes an **indication of low latency transmission**.

EX-1005, ¶72.

114. Thus, based on this disclosure, when the control channel 312 is located at the beginning of slot 1, which is really the second slot in the first TTI/sub-frame because the two slots are numbered slot0 and slot1, the preemption indication within control channel 312 is for the low latency transmission 315 that has occurred in the *prior slot* (slot0) and that has punctured the non-low latency transmission labeled 320. To illustrate this configuration, the blue box that says “second slot” in Fig. 3 above has two lines with arrows attached to it. The left-hand arrow is pointing to the control area 312 that is located at the beginning of the second slot (slot1) and the right-hand arrow is pointing to the data portion of the second slot (slot 1).

115. According to *Chen*, UEs can “use the indicator to mitigate low latency interference, generate channel estimates, and reliably decode the non-low latency communication.” EX-1005, Abstract.

3. Detailed Application of the Prior Art to the Challenged Claims

116. In this section, I primarily discuss the application of Ground 1 to the Challenged Claims and explicitly identify where Ground 2 sets forth a distinct application to the Challenged Claim

117. For the claim elements where Ground 2 is not explicitly discussed, the analysis for Ground 1 also applies to Ground 2.

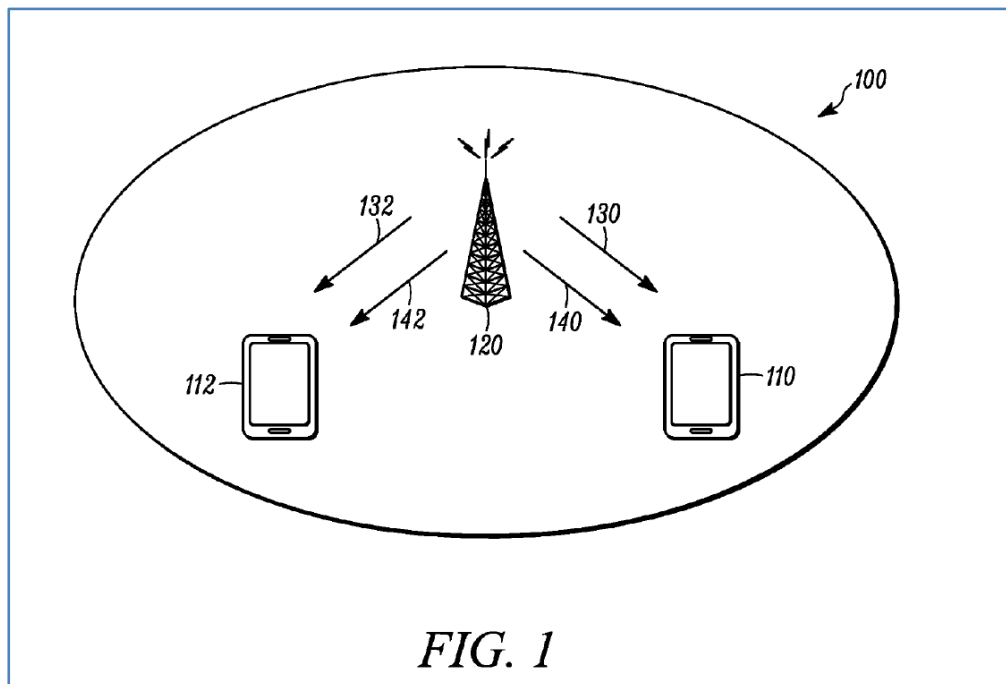
a. Claim 1

i. [1.0] A method of receiving a downlink (DL) signal by a first user equipment (UE), the method comprising:

118. To the extent the preamble is limiting, *Kuchibhotla* discloses⁴ this claim element.

119. *Kuchibhotla* discloses a user equipment (UE) device receiving downlink (DL) signals or messages from a base station (BS):

⁴ As used throughout this Declaration, “discloses” encompasses what a reference would teach, suggest, or render obvious to a POSITA.



EX-1004, FIG. 1. According to *Kuchibhotla*:

FIG. 1 is an example illustration of a system 100 according to a possible embodiment. The system 100 can include a first device 110 and a second device 120.... [T]he first device 110 may be referred to as a [user equipment] UE and the second device 120 may be referred to as a **base station**.

EX-1004, ¶42 (emphases added).

120. *Kuchibhotla* further discloses that data, signals and messages are transmitted between the UE and the BS using assigned channels on a downlink and an uplink:

In communication systems, assigned channels can be employed for **sending data and also for control signaling or messaging** of the system. Control signals or messages may be transmitted in Control Channels (CCHs) and are used for both the forward link transmissions,

also known as the **downlink transmission, from a network or base station to user equipment or device**, and reverse link transmission, also known as uplink transmissions, from the user equipment or device to the network or base station.

EX-1004, ¶45 (emphases added).

121. Finally, *Kuchibhotla* discloses that a UE can receive a marker signal transmitted by the BS on a downlink control channel, such as PDCCH:

When the marker 2130 is sent using symbols in the control region 2122, information conveyed using the marker 2130 can be sent using control channels, such as PDCCH or PHICH, that are typically used in the control region.

EX-1004, ¶84.

122. To the extent the preamble is limiting, *Kuchibhotla* thus discloses “a method of receiving a downlink (DL) signal by a first user equipment (UE).”

- ii. ***[1.1] receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling;***

123. As I will demonstrate below, *Kuchibhotla* teaches the UE receives a **marker** (*DL preemption indication information*) that indicates regular latency resources that have been allocated or used for low latency transmissions. The BS configures the UE to monitor a downlink control channel for this marker by assigning a *specific RNTI* value in a configuration message that is sent through

dedicated mode (i.e., *UE-specific*) **RRC signaling**. Monitoring is performed through “blind decoding” using the *specific RNTI* for the marker (i.e., **marker-RNTI**) as a CRC mask.

- a. *Kuchibhotla’s RRC DCI Message that is Masked with a **Marker-RNTI** is “DL Preemption Indication Information”*

124. *Kuchibhotla* teaches the base station uses the RRC protocol to send a DCI message to a UE that is masked with a Marker-RNTI in order to support the transmission of both low latency and regular latency transmissions in the same subframe. To that end, like the ’942 Patent, *Kuchibhotla* teaches that at least some of the resources assigned for low latency transmission can **overlap** with resources used for regular latency transmissions:

The resource assignment can assign a first set of time-frequency resources in a subframe for regular latency data transmission. Low latency data can be transmitted within a second set of time-frequency resources in the subframe. The second set can at least partially **overlap** with the first set.

EX-1004, ¶37.

125. Because different types of traffic can be sent with overlapping resources in the same subframe, *Kuchibhotla* discloses the use of an *RRC DCI Message that is Masked with a **marker-RNTI*** to inform a UE which of its resources in the subframe are being **used** or have been **punctured** for low latency traffic:

[I]n order to support regular latency transmissions in the same subframe

as low latency transmissions, **a marker can be transmitted where the marker can indicate which RE's are used in the subframe for low latency transmission.**

EX-1004, ¶82 (emphasis added). *Kuchibhotla* also discloses:

The information payload of **marker** transmission, such as 13 bits or 6 bits, can be used for identifying symbols, and other bits for **identifying Resource Block Groups (RBG's) punctured within** the user's, such as **the device's, allocation.**

EX-1004, ¶87 (emphasis added). Further:

For a device not receiving low latency transmission in that subframe, but having an allocation for other data transmission, **the marker transmission can tell which RE's in its allocation are used for low latency transmissions** so that the device can ignore them, null them, or otherwise not use them.

EX-1004, ¶76 (emphasis added).

126. *Kuchibhotla*'s DCI message masked with a marker-RNTI thus serves the same notification purpose as the "DL preemption indication information" described in the '942 Patent. EX-1001, 2:51-55 ("The downlink preemption indication information includes information for indicating superposed radio resources where a radio resource for providing a first service and a radio resource for providing a second service **overlap** each other."); 8:17-19 ("The present disclosure introduces various embodiments for notifying information on punctured

radio resources when radio resources are **dynamically punctured.**”); 10:29-33 (“it is necessary to inform if radio resources allocated for different services **overlap** each other or if one or more radio resources allocated to a service for sparsely generated traffic is **allocated for other services**”). Thus, *Kuchibhotla*’s DCI message masked with a marker-RNTI is “*DL preemption indication information.*”

b. *Kuchibhotla* Uses a **Dedicated Mode (“UE-specific”) RRC Signaling Message to Assign to the UE a Special RNTI for Monitoring PDCCH**

127. *Kuchibhotla* further discloses that (1) higher layer UE-specific RRC messaging configures a UE (2) to monitor (blindly decode) a DL control channel (3) using the special RNTI assigned to that UE. Specifically, *Kuchibhotla* discloses:

[A] device can receive a **higher layer configuration message**, where the higher layer can be higher than a physical layer. The higher layer message can be a **dedicated mode RRC (Radio Resource Control) message sent to the device**. In some embodiments it can be sent through broadcast system information message to all devices in a cell. **The device can determine, based on the higher layer configuration message, a first region of a subframe for receiving data packets. ...** The first region can be used for **control channel monitoring. ...** The device can monitor the first region, where **monitoring** can include **attempting to decode** the data packets in the first region. Attempting to decode can include **blind decoding** by the device.

EX-1004, ¶57 (emphasis added).

128. Thus, *Kuchibhotla* discloses that the UE receives a dedicated mode RRC message that configures the UE to monitor a downlink control channel through blind decoding.

129. Although the term “UE-specific” is not explicitly used to describe the configuration message, a POSITA reviewing *Kuchibhotla* would have understood that a “dedicated mode RRC” configuration message is a message sent by “*UE-specific radio resource control (RRC) signaling*.” First, as explained above in the State of the Art section, a POSITA would have understood that the term “dedicated mode” RRC signaling is synonymous with the term “UE-specific” RRC signaling, which signifies that the signaling is directed to a particular UE as opposed to the group of UEs within a cell. *See* §V.F.3, *supra*; EX-1012, 5:48-50 (“mobile network 100 may additionally or alternatively provide UE-specific control information in dedicated messages (i.e. non-broadcast messages) sent to mobile station(s)”; EX-1013, ¶14; EX-1014, ¶¶50, 58 (“signaling may be broadcast, or UE-specific (dedicated)”).

130. Second, this understanding in the art is consistent with *Kuchibhotla*’s disclosure that the “dedicated mode” message is “sent to **the device**,” in contrast to other embodiments in which other configuration information is “sent through broadcast system information message to **all devices in a cell**.” EX-1004, ¶57. Thus, a POSITA would have understood that *Kuchibhotla*’s disclosure of a

“dedicated mode RRC” higher layer configuration message is a disclosure of a message conveyed by “*a UE-specific radio resource control (RRC) signaling.*”

131. Third, *Kuchibhotla*’s description of how a “**particular UE**” is configured to **monitor (blindly decode)** a DL control channel confirms not only that the dedicated mode RRC configuration message is UE-specific, but that the message also includes special RNTIs. Specifically, *Kuchibhotla* teaches that the special RNTIs are assigned to the particular UE to use for a particular purpose, such as for monitoring a downlink control channel:

A **particular user equipment** can locate the low latency **control channel elements** corresponding to each LL-PDCCH candidate it is to **monitor (blindly decode)**. The CRC of each LL-PDCCH can be masked by a **unique identifier corresponding to the user equipment** that the base station is trying to schedule. **The unique identifier can be assigned to the UE by its serving base station.** This identifier can be known as a radio network temporary identifier (**RNTI**) and the one normally assigned to each UE at call admission can be the cell RNTI or C-RNTI. **A UE may also be assigned** a Semi-Persistent-Scheduling C-RNTI (SPS C-RNTI) or a temporary C-RNTI (TC-RNTI) or **a low latency RNTI (LL-RNTI)**. When **a UE configured to receive low latency transmission decodes a LL-PDCCH it may**, in addition to the C-RNTI (e.g., in case the LL-PDCCH can also be used for regular latency data packet assignment, with same DCI format size), also **apply its LL-RNTI in the form of a mask to the PDCCH CRC for successful LL-PDCCH decoding** to occur in case low latency

transmission control channel has been transmitted to the user equipment. ... [The UE] can use the control information from the decoded LL-PDCCH to **determine, for example, the resource allocation ... for the corresponding low latency data.**

EX-1004, ¶47 (emphasis added).

132. *Kuchibhotla* confirms that the configuration message that includes the UE's special RNTI for LL-PDCCH monitoring (e.g., LL-RNTI) is sent using RRC signaling:

During **blind decoding (or monitoring)** of LL data packets, the device may assume that the CRC of the payload of the LL data packet is encoded with a **special identifier** associated with LL data monitoring, for example a Low Latency-Radio Network Temporary Identifier (LL-RNTI). **The special identifier can be indicated to the device via higher layer (e.g., RRC) messages.**

EX-1004, ¶62 (emphasis added).

133. Thus, a POSITA reviewing *Kuchibhotla* would have understood that the disclosure of a **special identifier assigned to the particular UE via dedicated mode RRC messages** for the purpose of **monitoring (blindly decoding)** PDCCH candidates is a disclosure of a “*specific RNTI*” that is “*received ... through a UE-specific radio resource control (RRC) signaling.*”

- c. *Kuchibhotla's* Special RNTIs include a **Special CRC Mask (e.g., Marker-RNTI)** (“*specific RNTI*”) Assigned to the UE for Monitoring for a **Marker** (“*DL preemption indication*”

information”) That is Transmitted in **PDCCH** (a “DL control channel”)

134. *Kuchibhotla* discloses an embodiment in which the **marker** can be sent in a DL control channel, such as PDCCH:

When the marker 2130 is sent using symbols in the control region 2122, **information conveyed using the marker 2130 can be sent using control channels, such as PDCCH or PHICH**, that are typically used in the control region.

EX-1004, ¶84 (emphasis added); FIG. 21.

135. In this embodiment, the special RNTI that is used for decoding the DL control channel transmission is a special CRC mask (the CRC of the message is scrambled with the RNTI value) referred to as a **marker-RNTI**:

If **PDCCH is used for marker transmission**, the marker transmission can be **differentiated** from other control channel transmissions by using a **special CRC mask (e.g. marker-RNTI) for the marker transmissions**.

EX-1004, ¶84 (emphasis added).

136. Thus, a POSITA reviewing *Kuchibhotla* would have understood a **marker-RNTI** is one of the special RNTIs that the BS assigns to a particular UE at call admission. The marker-RNTI is a *specific RNTI* value that is assigned to the UE for the purpose of monitoring for a **marker** DCI message (*DL preemption indication information*) in **PDCCH** (*DL control channel*). In order to enable

monitoring of a PDCCH for a marker, a POSITA reviewing *Kuchibhotla* would have understood that the marker-RNTI (like the special LL-RNTI which also is used for PDCCH monitoring) would be assigned to the UE by the BS in the configuration message sent using **dedicated mode** (i.e., *UE-specific*) RRC signaling.

137. To the extent Patent Owner argues that *Kuchibhotla* does not explicitly disclose that the marker-RNTI is received through *UE-specific* RRC signaling, a POSITA would have found it obvious in view of *Kuchibhotla*'s teachings. *Kuchibhotla* teaches a UE is configured via UE-specific RRC messages that include special RNTIs (in addition to a C-RNTI) assigned to the UE for various purposes. One example of a special RNTI assigned to a UE at call admission is an LL-RNTI for monitoring control channels "to determine, for example, the resource allocation ... for the corresponding low latency data." EX-1004, ¶47. In embodiments in which the marker is transmitted to notify the UE of the resources used for low latency data, *Kuchibhotla* discloses that a special RNTI assigned to the UE for monitoring PDCCH is a marker-RNTI.

138. Assigning a marker-RNTI value in the UE-specific configuration along with other special RNTI values would have been a routine design choice within the ordinary skill of a POSITA that could be applied without modification to *Kuchibhotla* with a reasonable and predictable expectation of success. A POSITA would have been motivated to include the marker-RNTI value using UE-specific

RRC configuration signaling in addition to or instead of the LL-RNTI value for at least the reason that the marker-RNTI beneficially enhances the efficiency of monitoring PDCCH for control information regarding the transmission of LL traffic. That is, because the marker-RNTI allows the UE to differentiate the marker message from other types of control channel information, the UE can more efficiently identify resources that have been preempted for low latency transmissions. EX-1004, ¶84.

139. *Kuchibhotla* thus discloses using **dedicated mode RRC** messaging (*UE-specific RRC signaling*) to configure a particular UE to **monitor** (blindly decode) its **PDCCH** candidates (*DL control channel*) for a marker message (*DL preemption indication information*). *Kuchibhotla* discloses that the configuration message received by the particular UE includes a **unique/special identifier** (*specific RNTI*) value assigned to that UE (i.e., **marker-RNTI**) that the UE can apply to the messages it receives on the PDCCH to decode a **marker** message that identifies resources that have been used for low latency traffic (*specific RNTI for DL preemption indication information*).

140. *Kuchibhotla* therefore discloses this element [1.1].

- iii. *[1.2] after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI; and*

141. For the reasons discussed above for element [1.1], *Kuchibhotla* discloses that a DCI message masked with a marker-RNTI can be received on a downlink (DL) control channel, such as a PDCCH. As further discussed above for element [1.1], *Kuchibhotla* discloses that the UE monitors (blindly decodes) its PDCCH candidates for the marker message by applying its assigned marker-RNTI as the mask.

142. A POSITA reading *Kuchibhotla* would have understood that the value of the marker-RNTI would be sent from the base station to the UE prior to the UE monitoring PDCCH candidates for the marker. That is, as set out in the State of the Art section above, the monitoring technique described by the LTE standard, *Kuchibhotla* and the '942 Patent cannot be performed until the UE receives a higher level configuration message assigning the marker-RNTI value the UE is to use for blind decoding. *See* Section VI.D.1 - VI.D.2, *supra*.

143. *Kuchibhotla* thus discloses that, after receiving the marker-RNTI (*specific RNTI*), the UE blindly decodes (*monitors*) a PDCCH (*DL control channel*) for a marker (*DL preemption indication information*) by applying the marker-RNTI as a special CRC mask (*based on the received specific RNTI*).

iv. [1.3] receiving, by the first UE, the DL preemption indication information through a multicast signal,

144. For element [1.3], I present separate arguments for Ground 1 and Ground 2 below.

Ground 1

145. *Kuchibhotla* discloses that the UE can receive a DCI message that is masked with a marker-RNTI via a transmission common to multiple devices:

The **marker** transmission can be sent as a broadcast transmission **common to multiple devices**.

EX-1004, ¶76 (emphasis added).

146. A POSITA would have understood that *Kuchibhotla*'s disclosure of a "broadcast transmission **common to multiple devices**" is a disclosure of a "multicast signal" for multiple reasons. First, *Kuchibhotla*'s disclosure is consistent with the '942 Patent's description of a multicast signal. Specifically, the '942 Patent states that the DL preemption indication information can be sent through either a multicast signal or a unicast signal:

The base station may perform operations for transmitting the DL preemption identification information ... through **a multicast signal or a unicast signal** at step S630. ...

EX-1001, 12:1-4(emphasis added).

147. In describing these two scenarios, the '942 Patent explains:

For example, the DL preemption indication information may be transmitted through a **common search space or a group common search space** of a DL control channel. That is, the DL preemption indication information may be transmitted through **cell-specific signaling**. For another example, the DL preemption indication information may be transmitted through a **UE-specific search space** of a DL control channel. That is, the DL preemption indication information may be transmitted through **UE-specific signaling**.

EX-1001, 12:12-21 (emphasis added).

148. Further, in describing a multicasting embodiment, the '942 Patent teaches “the DL preemption indication information may be transmitted to **all eMBB UEs commonly in a corresponding cell** (or configured to monitor dynamic puncturing/superposition notification in the slot).” EX-1001, 13:49-53 (emphasis added); 14:18-21 (“As described above, the DL preemption indication information may be transferred equally to a plurality of UEs, or one or more UEs included in a group of UEs cell-specifically or by a multicasting technique.”).

149. Thus, a POSITA reviewing the '942 Patent would have understood that the '942 Patent describes a *multicast signal* as being transmitted using cell-specific signaling or through a common search space or a group-common search space that has been designated by the base station for its DL control channel (e.g., PDDCH). A POSITA also would have understood from the '942 Patent that a transmission common to multiple devices, such as all devices in a cell or subset of common

devices (e.g., eMBB UEs) in the cell, is a *multicast* message that is transmitted over the common search space of the DL control channel (e.g., PDCCH).

150. Second, as set out in the State of the Art section, this understanding that a transmission “common to multiple devices” is a *multicast signal* is consistent with the art. For example, *Lyu* discloses that data channel puncturing information is sent in “**a common search space**” in a downlink control channel or to the group of “**all terminals transmitting data in a punctured data channel.**” EX-1010, ¶¶21, 22, 24 (emphases added). During prosecution of the ’942 Patent, this disclosure was understood correspond to a *multicast signal*. EX-1002, 416-417 (Final Office Action dated 10/20/2021, pp. 2-3).

151. To the extent Patent Owner argues that *Kuchibhotla* does not sufficiently disclose that a “transmission common to multiple devices” is a *multicast signal*, a POSITA would have found it obvious to transmit *Kuchibhotla*’s marker message as a multicast message. For example, as discussed in the State of the Art section, the transmission of a data puncturing or preemption indication message in the common search space of the PDCCH, which is accessible by all UEs monitoring the PDCCH, was a well-known technique that makes efficient use of a network’s communication resources. That is, the base station designating a common search space for all the UEs in a cell to monitor is more efficient than assigning a UE-specific search space to every UE. *See* Section VI.D.4, *supra*.

152. Likewise, the base station transmitting a preemption information message, in the common search area of a PDCCH, that is masked with a special RNTI, which it previously has assigned to only a group of potentially UEs that would find the information useful, also was a well-known practice. EX-1015, ¶73 (“indication can be sent as a common signal to at least the UEs whose transmission overlaps the [punctured] region”); EX-1010, ¶¶22, 24 (“notify the data channel puncturing information to all terminals transmitting data in the punctured data channel”). Thus, sending information as a multicast message to only a group of common devices that would benefit from the transmission (e.g., UEs in the cell that need to know if their non-LL data transmission has been punctured with a LL data transmission) was a conventional and efficient design choice that a POSITA would be motivated to implement in *Kuchibhotla*’s network with a predictable expectation of success.

153. *Kuchibhotla* thus discloses element [1.3].

Ground 2

154. *Kuchibhotla* in view of *Chen* renders element [1.3] obvious.

155. *Chen* discloses a wireless communication system in which “low latency operation may occur concurrently with non-low latency operation,” which can result in UEs experiencing performance degradation. EX-1005, ¶6. *Chen* teaches:

In some cases, the low latency transmission may **puncture** the

resources allocated to the non-low latency transmission, which may tend to cause interference for the first UE 115. ... This may result in decoding failures ...

EX-1005, ¶57 (emphasis added).

156. To address the problem caused by resource puncturing, *Chen* discloses that the BS generates an **indicator** that informs the UE where and when low latency communications are occurring (“*DL preemption indication information*”). EX-1005, ¶58 (“the indication may disclose the frequency resources that are utilized by a low latency communication and which symbols are being used”). *Chen* further discloses:

the **indicator** may be included as part of a **PDCCH** transmitted in the first symbol period of the next **subframe**. . . . In some cases, the **indicator** may be sent in symbols that include broadcast-type or **multicast**-type content.

EX-1005, ¶62; *see also* EX-1005, FIG. 3 and ¶72 (“control channel 312 may be PDCCH . . . and may represent broadcast-type or **multicast**-type information that includes an indication of low latency transmission”), *see also* ¶73 (“This location or placing of the control channel 312 (and indicator) may be referred to herein as the “middle” of a subframe, and **may or may not be at the beginning of slot 1** or the end of slot 0.”)

157. Thus, *Chen* discloses an **indicator** message (“*DL preemption indication information*”) sent as **multicast-type information** (“*multicast signal*”) in **PDCCH** (“*DL control channel*”) that provides notification of punctured resources in a **previous slot** (“*prior slot*”).

158. According to *Chen*, UEs can “use the indicator to mitigate low latency interference, generate channel estimates, and reliably decode the non-low latency communication.” EX-1005, Abstract.

159. Thus, *Chen* and *Kuchibhotla* are in the same field of endeavor, i.e., supporting both non-low latency and low latency transmissions in the same subframe and providing notification to one or more UEs of a non-low latency transmission that has been punctured for low latency data. A POSITA thus would have been motivated to look to *Chen*’s teachings and use them with *Kuchibhotla*’s techniques. Further, a POSITA would have been motivated to combine *Chen*’s multicast-type puncturing indicator with *Kuchibhotla* for at least the reason that sending the indicator to a common group of UEs, such as non-latency sensitive UEs, as a multicast is an efficient way to improve performance and reliability, as taught by *Chen*. E.g., EX-1005, ¶78 (non-latency sensitive UEs “may utilize low latency indicators to facilitate the decoding of data”). See also EX-1015, ¶68 (sending notification to group of latency-tolerant UEs so that they can “receive transmission

without considering the punctured regions, thereby potentially reducing decoding errors”).

160. Further, a POSITA would have been motivated to multicast *Kuchibhotla*’s marker message using a common search space of PDCCH in order to make efficient use of system and UE resources. For example, as taught by *Chen*,

PDCCH can carry DCI messages associated with multiple users, and each UE 115 may decode the DCI messages that are intended for it. . . . To reduce power consumption and overhead at the user equipment, **a limited set of control channel element (CCE) locations can be specified for DCI associated with a specific UE 115.** CCEs may be grouped . . . and a set of CCE locations in which the user equipment may find relevant DCI may be specified. These CCEs may be known as a search space. The search space can be partitioned into two regions: **a common CCE region or search space** and a UE-specific (dedicated) CCD region or search space. The common CCE region is monitored by all UEs served by a base station 105

EX-1005, ¶52 (emphasis added). Thus, a POSITA would have been motivated to send *Kuchibhotla*’s “transmission common to multiple devices” as a multicast signal in a common search space of PDCCH that would be decoded by a common group of UEs for at least the reason of reducing power consumption and overhead at the user equipment, as taught by *Chen*.

161. Further, as demonstrated in the State of the Art section, sending a preemption information message in a common search area where it can be decoded

by a group of UEs as a multicast signal was within the ordinary skill of a POSITA and could be implemented with a reasonable and predictable expectation of success. See Section VI.D.4, *supra*. EX-1015, ¶¶68, 75; EX-1010, ¶¶21, 22, 24; EX-1006, p. 21.

162. *Kuchibhotla* in view of *Chen* thus renders obvious element [1.3].

- v. ***[1.4] wherein the specific RNTI received through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI),***

163. For reasons discussed above for element [1.1], *Kuchibhotla* discloses that the marker-RNTI value (*specific RNTI*) is received by the UE through *UE specific RRC signaling*. See §VII.A.2.ii, *supra*. The marker-RNTI is a “special CRC mask ... for the marker transmissions” (*newly defined RNTI other than at least a cell-RNTI (C-RNTI)*). EX-1004, ¶¶84 and ¶47 (describing assignment of special RNTIs to the UE at call admission in addition to the C-RNTI). *Kuchibhotla* therefore discloses element [1.4].

- vi. ***[1.5] wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received,***

164. For element [1.5], I present separate arguments for Ground 1 and Ground 2 below.

Ground 1

165. *Kuchibhotla* discloses that subframes are used for communications between the UE and BS, and that subframes are composed of time slots. EX-1004, ¶45 (“each subframe can be composed of two slots each having a 0.5 ms length”).

166. *Kuchibhotla* also teaches the transmitted RRC/DCI message masked with a marker-RNTI is a DL preemption indication information, “*indicates preempted resource information*”:

For a device not receiving low latency transmission in that subframe, but having an allocation for other data transmission, **the marker transmission can tell which RE’s in its allocation are used for low latency transmissions** so that the device can ignore them, null them, or otherwise not use them.

EX-1004, ¶76 (emphasis added). *Kuchibhotla* also discloses:

The information **payload of marker transmission**, such as 13 bits or 6 bits, can be used for identifying symbols, and other bits for **identifying Resource Block Groups (RBG’s) punctured within the user’s, such as the device’s, allocation.**

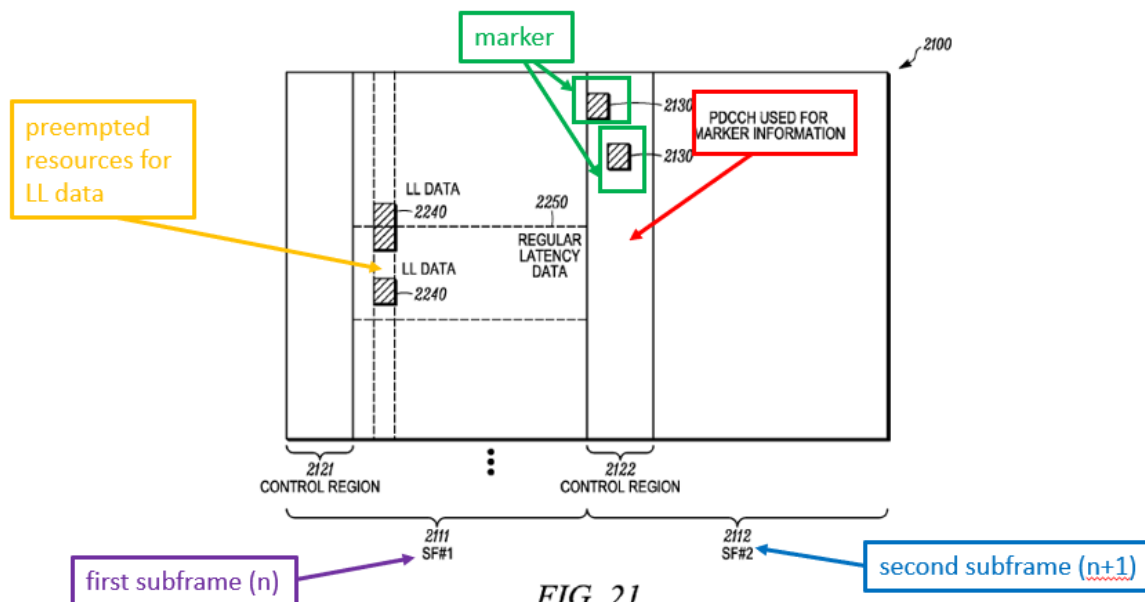
EX-1004, ¶87 (emphasis added).

167. A POSITA reading *Kuchibhotla* would have understood that the information contained in the marker message identifying the REs and RBGs within a UE’s allocation that have been used for low latency transmissions is information “*indicat[ing] preempted resource information.*”

168. *Kuchibhotla* discloses that the marker message can be received in a subframe after the subframe in which resources have been preempted:

FIG. 21 is an example illustration 2100 of a first subframe 2110 and a second subframe 2112 according to a possible embodiment. The first subframe can include a control region 2121, low latency data 2240, and a regular latency data region 2250. The second subframe 2112 can include a control region 2122 including a marker 2130. A marker transmission 2130 in one subframe 2112 (e.g. subframe $n+1$) may indicate the REs/LCEs/DCEs/CCEs/RBs/RBGs used for low latency transmission in OFDM symbols of another subframe 2121 (e.g. subframe n).

EX-1004, ¶84 (emphasis added).



EX-1004, FIG. 21 (annotated).

169. *Kuchibhotla* further discloses:

The **marker** signal can be transmitted in a **subframe** immediately following the **subframe** that includes the **time-frequency resources**. A **control channel** can be transmitted as the **marker** signal in the immediately following **subframe**. The control channel can indicate the presence of **low latency data transmission** in the **subframe** that includes the **time-frequency resources**.

EX-1004, ¶131 (emphasis added).

170. To the extent Patent Owner argues that *Kuchibhotla* does not sufficiently disclose a “DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received” based on the disclosure for the “immediately following subframe,” a POSITA would have found it obvious that the **marker** signal transmitted in a **subframe** immediately following the **subframe** would be in the first slot of this subframe because each subframe is divided into two slots and the marker signal would be transmitted in the first slot of this subframe. A POSITA would have also understood that the preceding subframe with the LL data transmission would also be composed of two slots and the LL data transmission could be in the first slot as shown in Fig. 21 above or it could be in the second slot of this subframe. Therefore, if the LL data transmission is in the second slot (right-

hand side of the subframe) and the marker signal is in the first slot (left-hand side of the subframe), the “DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received” would occur.

171. Thus, sending the LL data in the second slot of a prior subframe and sending the preemption notification in the first slot of the following subframe would meet this limitation and would not require modification of the invention because the functionality of choosing either slot of a subframe to transmit the LL data existed.

172. *Kuchibhotla* thus discloses that the marker (*DL preemption indication information*) is transmitted to identify resources within a UE’s allocation that have been used or punctured for low latency transmissions (*indicates preempted resource information*) in a prior subframe (*prior slot*), as required by element [1.5].

Ground 2

173. *Kuchibhotla* in view of *Chen* renders element [1.5] obvious.

174. As described in Section IX.A.2 above regarding the disclosures of *Chen*, *Chen* discloses a “DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received.” Specifically, for at least Fig. 3 and its description text, *Chen* discloses that the LL data 315 can be transmitted in the

first slot of subframe 310-a and the preemption indication information 312 can be transferred at the beginning of the second slot in the same subframe.

175. Thus, based on this disclosure, when the control channel 312 is located at the beginning of slot 1, which is really the second slot in the first TTI/sub-frame because *Chen* numbers the two slots in a subframe as slot0 and slot1, the preemption indication within control channel 312 is in slot1(second slot) and the low latency transmission 315 is in slot0 (first slot or *prior slot*). In other words, both of these slots are in the same subframe so the preemption slot immediately follows the slot with LL data.

176. *Kuchibhotla* in view of *Chen* thus renders obvious element [1.5].

vii. [1.6] wherein the specific RNTI is received with information related to time and frequency, and

177. *Kuchibhotla* discloses that, in addition to the special RNTIs (e.g., marker-RNTI) (*specific RNTI*) assigned to the UE, the RRC configuration message provides the possible locations (i.e., *time and frequency information*) for the marker transmission. Specifically, with reference to FIG. 12, *Kuchibhotla* discloses:

At 1220, **a higher layer configuration message can be received. ...**

At 1230, **a first region of a subframe for receiving data packets can be determined based on the higher layer configuration message.**

The first region can be **a first time-frequency region** in a sequence of regions. ... For example, the first region can be **a control region**

including at least one physical downlink control channel that includes control channel elements. ...

The data packets in the first region can be **low latency data packets**. ...

At 1240, the first region can be **monitored**. For example, control channel monitoring can be performed in the first region. ...

[M]onitoring can imply, such as include, **blind decoding** data packets.

...

At 1250, data in the data packet in the first region can be decoded. ...

[S]uccessful decoding of a control channel in the first region can be determined using a first identifier. The first identifier can be a Cell Radio Network Temporary Identifier (C-RNTI) received in the higher layer configuration message. **Successful decoding of data in the data packet in the first region can also be determined using a second identifier.** The second identifier can be a Low Latency Radio Network Temporary Identifier (**low latency-RNTI**) received in the **higher layer configuration message**.

EX-1004, ¶¶104-108 (emphases added).

178. *Kuchibhotla* thus discloses that the higher layer RRC configuration message indicates the time-frequency region that the UE should monitor using its special RNTI, and that the time-frequency region can be a PDCCH.

179. *Kuchibhotla* discloses an embodiment in which information “sent using control channels, such as PDCCH” can include the marker. In such embodiments,

the special RNTI that the UE applies for monitoring PDCCH is the marker-RNTI. EX-1004, ¶84.

180. *Kuchibhotla* teaches that the time-frequency information in the higher layer configuration message can indicate possible locations for the marker:

The possible locations of marker transmission can be indicated to the user equipment via higher layer (e.g. RRC) signaling.

EX-1004, ¶83 (emphasis added), ¶131 (“A higher layer can indicate where the marker can be transmitted, such as which of different candidate marker locations is being used.”).

181. *Kuchibhotla* confirms that the marker locations indicated in the higher layer configuration message are time-frequency resources:

At 1615, higher layer signaling can be received in a subframe, where the higher layer can be a layer higher than a physical layer. **The higher layer signaling can indicate** a set of OFDM symbols where low latency data may be transmitted, a set of resource blocks where low latency data may be transmitted, **a set of OFDM symbols where a marker signal may be transmitted, and/or a set of resource elements where a marker signal may be transmitted.**

EX-1004, ¶135 (emphasis added).

182. As discussed in the State of the Art section, a “location,” “a set of OFDM symbols,” and “a set of resource elements” in which the marker can be transmitted are “*information related to time and frequency.*” See Section VI.D.5,

supra. This understanding is consistent with *Kuchibhotla*'s disclosure that “a **resource element** (RE) can represent a single subcarrier for a single **OFDM symbol** period in the subframe” and “a **resource element** can be a smallest identifiable **time/frequency/code/spatial** domain resource unit within the subframe.” EX-1004, ¶56 (emphases added).

183. Thus, a POSITA reading *Kuchibhotla* would have understood that the special RNTI assigned to the UE to monitor possible locations for the *time/frequency information* contained in the marker message (i.e., message masked with a marker-RNTI) is received in the higher layer configuration message that indicates the possible marker locations that the UE should attempt to decode (i.e., blindly monitor by applying the special RNTI). EX-1004, ¶¶36, 37, 47, 57, 62, 81, 82, 84, 105-108, 131, 135; *see also* Sections VI.D.1-VI.D.3, VI.D.5.

184. *Kuchibhotla* thus discloses element [1.6].

viii. [1.7] wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling.

185. *Kuchibhotla* discloses that the UE receives higher layer signaling that indicates OFDM symbols or resource elements (*information related to time and frequency*) where the marker may be transmitted (*received for the reception of the DL preemption indication information*). EX-1004, ¶¶83, 131.

186. *Kuchibhotla* further discloses that the higher layer signaling can be dedicated mode RRC signaling (*UE-specific RRC signaling*). EX-1004, ¶¶47, 57. See also Sections IX.A.3.a.ii, IX.A.3.a.vii, *supra*.

187. *Kuchibhotla* thus discloses element [1.7].

b. Claim 2

i. [2.0] *The method according to claim 1, wherein*

188. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [2.0] for reasons discussed above for claim 1 in Section IX.A.3.a.

ii. [2.1] *at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE.*

189. *Kuchibhotla* discloses that the communication system can include devices configured for low latency transmissions (*first UE*), as well as devices configured for normal latency transmissions (*second UE*):

The present disclosure is directed to wireless transmissions, signaling, and frame structures for devices configured for low latency data packets while maintaining backward compatibility with devices configured for normal latency data packets.

EX-1004, ¶3.

190. Further, *Kuchibhotla* discloses that “[r]egular latency and low latency transmissions may be received by different users, such as devices and/or UEs, in the same subframe.” EX-1004, ¶82.

191. FIG. 5 illustrates an example Transmit Time Interval (TTI) where a low latency allocation is mixed with a regular (i.e., legacy) latency allocation in a 1 ms legacy TTI 500:

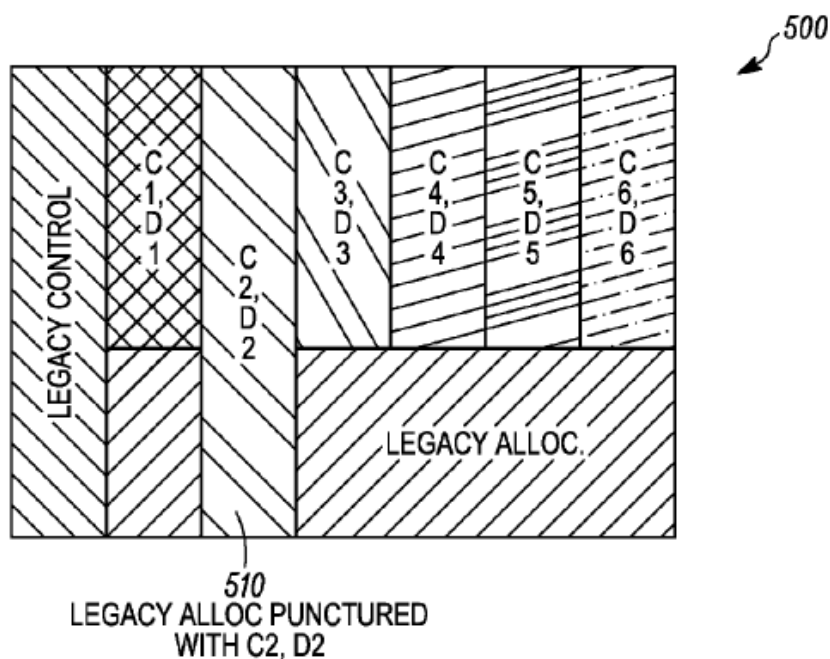


FIG. 5

EX-1004, FIG. 5.

192. *Kuchibhotla* discloses for Fig. 5:

The legacy TTI 500 can include low latency control information C and low latency data D. For example, **C1 can be control information for**

a first device and D1 can be data for the first device, etc. The illustrated areas, such as C1, D1, may also just have data without control information. The low latency data and control information can coexist with legacy allocations, such as in a 1 ms legacy TT. The legacy allocation can be punctured 510 to accommodate a short TTI.

EX-1004, ¶77 (emphasis added).

193. A POSITA viewing *Kuchibhotla* would have understood that FIG. 5 illustrates that resources allocated to a first UE for low latency transmissions (e.g., C1D1 or just D1) have at least a shorter time-domain scheduling unit than resources allocated to a second UE that can receive regular latency transmissions, i.e., the box labelled “Legacy Alloc.” in the same subframe that obviously has a much longer *time-domain* allocation than the low latency transmissions.

194. *Kuchibhotla* therefore discloses element [2.1].

c. **Claim 3**

i. ***[3.0] The method according to claim 1, wherein***

195. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [3.0] for reasons discussed above for claim 1 Section IX.A.3.a.

ii. ***[3.1] the DL preemption indication information is received through a common search space of the DL control channel.***

196. *Kuchibhotla* discloses that “information conveyed using the marker 2130 can be sent using control channels, such as PDCCH.” EX-1004, ¶84.

Ground 1

197. As described for at least element [1.3] of Ground 1 above, a POSITA would have understood that a marker transmission received on a downlink control channel (e.g., PDCCH) as a transmission **common to multiple devices** would be received through a *common search space of the DL control channel*. See Sections VI.D.1-VI.D.4, *supra*.

198. *Kuchibhotla* therefore discloses element [2.1].

Ground 2

199. *Kuchibhotla* in view of *Chen* renders element [2.1] obvious for at least the reasons discussed above for element [1.3] of Ground 2. See IX.A.3.a.iv, *supra*.

d. Claim 5

i. [5.0] A method of transmitting a downlink (DL) signal by a base station (BS), the method comprising:

200. To the extent the preamble is limiting, *Kuchibhotla* discloses this element. *Kuchibhotla* discloses a user equipment (UE) device receiving downlink signals or messages from a base station (BS):

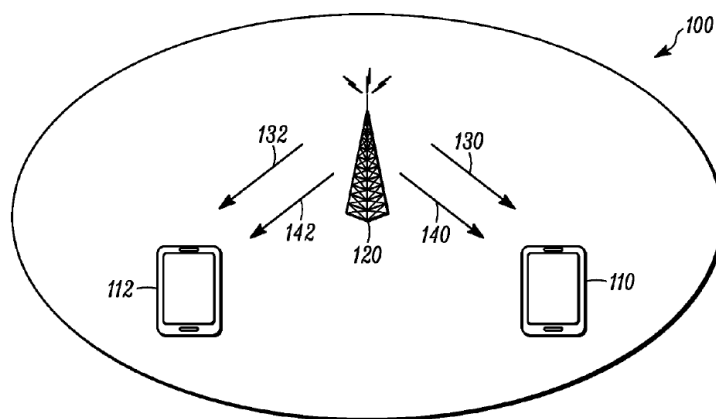


FIG. 1

EX-1004, FIG. 1.

201. According to *Kuchibhotla*:

The system 100 can include a first device 110 and a second device 120.... [T]he first device 110 may be referred to as a [user equipment] UE and the second device 120 may be referred to as a base station.

EX-1004, ¶42.

202. *Kuchibhotla* further discloses that data, signals and messages are transmitted between the UE and the base station using assigned channels on a downlink and an uplink:

In communication systems, assigned channels can be employed for sending data and also for control signaling or messaging of the system. Control signals or messages may be transmitted in Control Channels (CCHs) and are used for both the forward link transmissions, also known as the downlink transmission, from a network or base station to

user equipment or device, and reverse link transmission, also known as uplink transmissions, from the user equipment or device to the network or base station.

EX-1004, ¶45.

203. Finally, *Kuchibhotla* discloses that a BS can transmit a marker signal to a UE on a downlink control channel:

When the marker 2130 is sent using symbols in the control region 2122, information conveyed using the marker 2130 can be sent using control channels, such as PDCCH or PHICH, that are typically used in the control region.

EX-1004, ¶84.

204. FIG. 15 below illustrates the operation of a BS that includes transmitting to a UE a higher layer configuration message, resource assignments, regular latency and low latency data, and a marker signal:

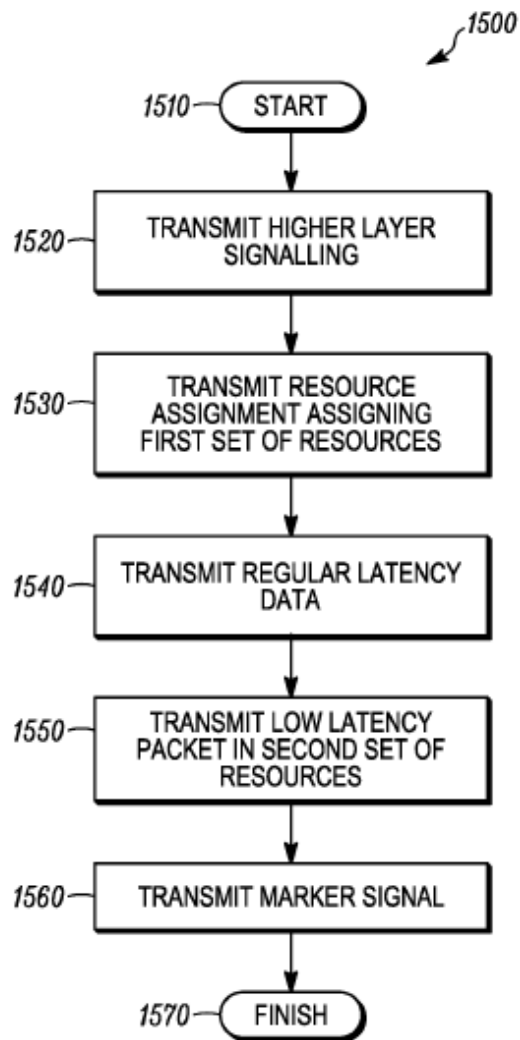


FIG. 15

EX-1004, FIG. 15.

205. To the extent the preamble is limiting, *Kuchibhotla* thus discloses limitation [5.0]. *See also* Section IX.A.3.a.i, *supra*.

- ii. ***[5.1] configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information;***

206. *Kuchibhotla* discloses this limitation for the same reasons as set forth for limitations [1.1] and [1.2]. See Sections IX.A.3.a.ii-IX.A.3.a.iii;

- iii. ***[5.2] transmitting, from the BS, the configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling; and***

207. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.1]. See Section IX.A.3.a.ii.

- iv. ***[5.3] transmitting, from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal***

208. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [5.3] for the same reasons as set forth for elements [1.2] and [1.3]. See Sections IX.A.3.a.iii-IX.A.3.a.iv.

- v. ***[5.4] wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI);***

209. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.4]. See Section IX.A.3.a.v.

- vi. ***[5.5] wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is transmitted,***

210. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [5.5] for the same reasons as set forth for limitations [1.5]. See Section IX.A.3.a.vi.

- vii. ***[5.6] wherein the specific RNTI is transmitted with information related to time and frequency, and***

211. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.6]. See Section IX.A.3.a.vii.

- viii. ***[5.7] wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication information by the first UE through the UE-specific RRC signaling.***

212. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.7]. See Section IX.A.3.a.viii.

e. **Claim 6**

- i. ***[6.0] The method according to claim 5, wherein***

213. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [6.0] for reasons discussed above for claim 5. See Section IX.A.3.d.

- ii. ***[6.1] at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE.***

214. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [2.1]. See Section IX.A.3.b.ii.

f. **Claim 7**

- i. ***[7.0] The method according to claim 5, wherein***

215. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [7.0] for reasons discussed above for claim 5. See Section IX.A.3.d.

- ii. ***[7.1] the DL preemption indication information is transmitted through a common search space of the DL control channel.***

216. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [7.1] for reasons discussed above for element [3.1]. See Section IX.A.3.c.ii.

g. **Claim 9**

- i. ***[9.0] A user equipment (UE) for receiving a downlink (DL) signal, the UE comprising:***

217. To the extent the preamble is limiting, *Kuchibhotla* discloses this claim element. As discussed for element [1.0], *Kuchibhotla* discloses a UE configured to receive a downlink signal from a BS, including a marker signal transmitted on a downlink control channel. See IX.A.3.a.i.

218. A block diagram of a UE 1700 is shown in FIG. 17:

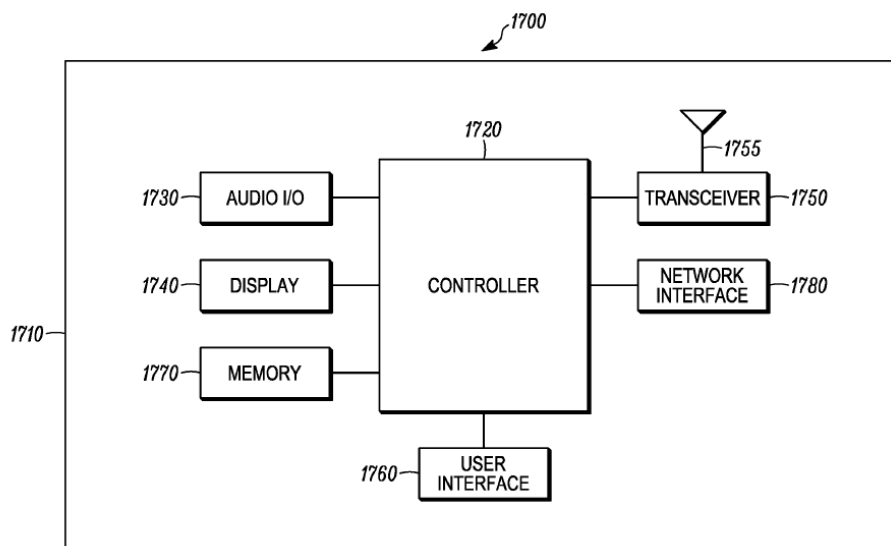


FIG. 17

EX-1004, FIG. 17.

219. *Kuchibhotla* discloses that UE 1700 includes a controller 1720, a transceiver 1750 coupled to the controller 1720, and a transceiver 1750 coupled to the controller 1720 and an antenna 1755. *Kuchibhotla* further discloses: “The element of the apparatus 1700 can perform the device and apparatus methods and processes described in the disclosed embodiments.” EX-1004, ¶143.

220. *Kuchibhotla* therefore discloses element [9.0].

- ii. ***[9.1] a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling;***

221. *Kuchibhotla* discloses that transceiver 1750 “can include a transmitter and/or a receiver.” EX-1004, ¶144.

222. Further, *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.1]. See Section IX.A.3.a.ii.

- iii. ***[9.2] after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI,***

223. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.2]. See Section IX.A.3.a.iii.

- iv. ***[9.3] wherein the receiver further configured to receive the DL preemption indication information through a multicast signal,***

224. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [9.3] for reasons discussed above for element [1.3]. See Section IX.A.3.a.iv.

- v. ***[9.4] wherein the specific RNTI received through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI),***

225. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.4]. See Section IX.A.3.a.v.

- vi. ***[9.5] wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received,***

226. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [9.5] for reasons discussed above for element [1.5]. See Section IX.A.3.a.vi.

- vii. [9.6] wherein the specific RNTI is received with information related to time and frequency, and**

227. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.6]. See Section IX.A.3.a.vii.

- viii. [9.7] wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling.**

228. *Kuchibhotla* discloses this limitation for the same reasons as set forth for element [1.7]. See Section IX.A.3.a.viii.

h. Claim 10

- i. [10.0] The UE according to claim 9, wherein**

229. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [10.0] for the same reasons as set forth for claim 9. See Section IX.A.3.g.

- ii. [10.1] at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the UE are different from second radio resources allocated for another UE.**

230. *Kuchibhotla* discloses element [10.1] for the same reasons as set forth for element [2.1]. See Section IX.A.3.b.ii.

i. Claim 11

- i. [11.0] The UE according to claim 9, wherein**

231. *Kuchibhotla* or *Kuchibhotla* in view of *Chen* renders obvious element [11.0] for reasons discussed above for claim 9. See Section IX.A.3.g.

- ii. [11.1] the DL preemption indication information is received through a common search space of the DL control channel.***

232. *Kuchibhotla* discloses or *Kuchibhotla* in view of *Chen* renders obvious element [11.1] for reasons discussed above for element [3.1]. See Section IX.A.3.c.ii.

X. CONCLUSION

233. For at least the reasons addressed above, it is my opinion that the Challenged Claims of the '942 Patent are invalid as obvious.

234. 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.

235. I declare that all statements made herein of my knowledge are true, 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.

236. I declare under penalty of perjury that the foregoing is true and correct.

Executed on: Dec 17, 2024 Mark R. Lanning
Mark R. Lanning