IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS,
T-MOBILE USA, INC., AT&T SERVICES, INC.,
NOKIA OF AMERICA, CORP., ERICSSON INC., AND GOOGLE LLC

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

PETITION FOR *INTER PARTES* REVIEW OF U.S. PAT. NO. 11,405,942

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1003	Declaration of Petitioners' Expert ("Lanning Declaration")
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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
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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
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I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311 *et seq*. and 37 C.F.R. §§ 42.1 *et seq*., 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"), (collectively "Petitioners") (collectively "Petitioners") hereby petition for an *inter partes* review of U.S. Patent No. 11,405,942 (the "'942 Patent"). Petitioners respectfully submit that claims 1-3, 5-7 and 9-11 (the "Challenged Claims") of the '942 Patent are unpatentable under 35 U.S.C. §103 in view of the prior art herein.

II. OVERVIEW

The Challenged Claims are unpatentable as obvious in view of the prior art. The 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.

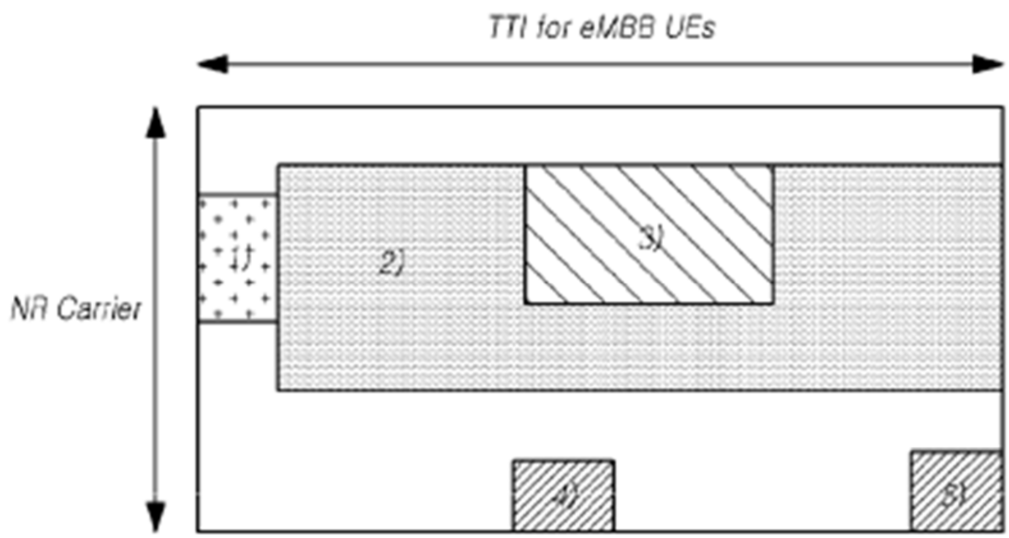
Preemption can be used in wireless communication systems for the purpose of concurrently supporting different usage scenarios that have different transmission/reception requirements. As an example of how usage scenarios can differ in their transmission/reception requirements, a mobile broadband service generally requires longer time-domain resources for providing a service to many users, while an ultra-reliable service generally requires shorter time-domain resources to provide low latency. EX-1001, 1:31-62. EX-1003 ¶70.

The ’942 Patent (EX-1001) 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. EX-1003 ¶71.

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. EX-1003 ¶72.

To support preemption-based scheduling of resources, 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, 8:62-9:9, 10:29-35, 11:15-23. EX-1003 ¶73.

FIG. 2 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. EX-1003 ¶74.

FIG. 2 shows a Time Transmission Interval (TTI) that is being used for UEs receiving a regular latency 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. EX-1003 ¶75.

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. EX-1003 ¶76.

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 sent by the base station using cell-specific signaling). Alternatively, the DL preemption indication information may be received through a UE-specific search space of a DL control channel (i.e., a unicast sent by the base station using UE-specific signaling). EX-1001, 11:24-32, 12:13-25. EX-1003 ¶77.

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. 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. EX-1003 ¶78.

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 of wireless communication network or any specific usage scenario or service. The prior art cited herein discloses the same claimed concepts.

Specifically, just like the '942 Patent, and as demonstrated below, *Kuchibhotla* (EX-1003) is directed to a dynamic resource scheduling solution to solve the problem of efficiently supporting different types of usage scenarios in wireless communication systems, including low latency usage scenarios. And *Kuchibhotla's* solutions employ the same features required by the Challenged Claims. That is, *Kuchibhotla* discloses:

- providing post-notification that resources within a UE's allocation have been used for low latency traffic by transmitting a **marker** ("*DL* *preemption indication information*") using a **transmission common to multiple UEs** ("*multicast signal*"); and

- configuring the UE through **dedicated mode** ("*UE-Specific*") **RRC signaling** to monitor specific **downlink control channel time-frequency** resources ("*DL control channel*" / "*information related to time and frequency*") for the marker,
- where monitoring the specified control channel resources for the **marker** is performed through **blind decoding** using a specific **marker-RNTI** assigned to the UE in the UE-specific RRC configuration message for that purpose.

This Petition thus demonstrates a reasonable likelihood of unpatentability for all the challenged claims and therefore Petitioners respectfully request that the Board institute IPR.

III. GROUNDS FOR STANDING (37 C.F.R. § 42.104(A))

Petitioners certify that the '942 Patent is available for IPR and that Petitioners are not barred or estopped from requesting an IPR of the Challenged Claims on the grounds identified herein. 37 C.F.R. § 42.104(a).

IV. REASONS FOR REQUESTED RELIEF

As explained below and in the Declaration of Petitioners' Expert Mark Lanning (EX-1003, ¶¶1-233; EX-1018), the Challenged Claims were obvious over the prior art to a person of ordinary skill in the art ("POSITA") at the time of the invention.[1]

V. BACKGROUND

A. Summary of the '942 Patent

As described in the Overview, the '942 Patent claims a technique and apparatus for preemption-based scheduling of downlink resources in a wireless communication system to support usage scenarios having different transmission/reception requirements. In the Challenged Claims, to support preemption, a UE is configured via UE-specific RRC signaling to monitor a DL control channel for preemption notification information that indicates preempted resources in a prior slot. EX-1003 ¶78.

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 wireless communication system. EX-1001, 1:31-33. EX-1003 ¶69.

B. Prosecution History

The '942 Patent issued from U.S. Patent Application No. 16/349,874, which

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[1] All emphasis in quoted materials, and figure annotations, in the Petition were added by Petitioners.

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.

During prosecution of the ’942 Patent, the claims were repeatedly rejected and amended. EX-1002.

In a non-final rejection, the Examiner rejected the independent claims as being obvious in view of U.S. Patent Publication No. 2019/0200235) to Lyu et al. (“Lyu”) in view of U.S. Patent Publication No. 2018/0070341 to Islam et al. (“Islam”), U.S. Patent Publication No. 2018/0035332 to Agiwal et al. (“Agiwal”). Amongst other assertions, the Examiner found that Lyu discloses:

> 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 (annotated).

In response, the Applicant amended the independent claims to require that the specific RNTI is “a newly defined RNTI” received “through a UE-specific radio resource control (RRC) signaling. EX-1002, 397. The Applicant’s arguments did not challenge the Examiner’s assertion that *Lyu* discloses that the UE receives the DL preemption indication information through a multicast signal. EX-1002, 403-408. EX-1003 ¶84.

The claims were then finally rejected. EX-1002 416-421.

The Applicant added the following limitations to each of the independent claims:

- 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, 452-453.

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 <u>information related to time and frequency information</u> are used <u>for receiving of the DL preemption indication information</u>." 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 <u>for the reception of the DL preemption indication information</u>." EX-1002 458-459 (emphasis original). EX-1003 ¶87.

In the last rejection before allowance, all pending claims were rejected as obvious. EX-1002, 464.

In response, the Applicant further amended 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, 464. The Applicant argued that this "novel feature" – "the information related to time and frequency is transmitted <u>through the UE specific RRC singling</u> [sic]" – differentiated the claims from the prior art. EX-1002, 502 (emphasis original). EX-1003 ¶89.

C. Priority Date

Patent Owner bears the burden of establishing that it is entitled to the priority date of Korean Patent Application No. KR 10-2016-0152659 filed on November 16, 2016, and/or Korean Patent Application No. KR 10-2017-0151983 filed on November 15, 2017. For purposes of this Petition, because each of the cited prior art references is prior art to the Challenged Claims of the '942 Patent regardless of whether the Challenged Claims are entitled to the filing date of either Korean Patent Application, that issue does not need to be resolved currently.

D. Claim Construction

Petitioners apply the plain and ordinary meaning of each claim term herein. The prior art herein meets each claim element under any reasonable construction.

To the extent that Petitioners allege indefiniteness in any parallel case involving the '942 Patent, the Board has consistently held that Petitioners may assert indefiniteness positions in parallel litigation, while simultaneously arguing that the prior art discloses the elements containing those terms. *See Target Corp. v. Proxicom Wireless, Inc.*, IPR2020-00979, Paper 11 at 16-17 (PTAB Dec. 4, 2020);

Sony Interactive Entertainment LLC v. Bot M8, LLC, IPR2020-00963, Paper 9 at 11 (PTAB Nov. 20, 2020); *see also Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 812-814 (Fed. Cir. 2021).

E. Person of Ordinary Skill in the Art

A POSITA in November 2016 would have had a bachelor's degree in electrical engineering, computer engineering, or a related discipline, knowledge of relevant 3GPP standards, and at least two years of experience working in wireless communications. A POSITA may trade more education for less experience and vice-versa. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. EX-1003 ¶¶28-32.

F. State of the Art

The following section describes the relevant state of the art as of the Priority Date. The prior art references, and the discussions of what was known to a POSITA, provide the factual support for the general description of the state of the art, 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

The terminology and acronyms used in the '942 Patent were well-known to a POSITA as of the Priority Date. 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. *See e.g.,* EX-1006 (36.213) , pp. 7, 19-25, 53-56, 66; EX-1009 pp. 11-12; *see also* EX-1003 ¶40.

The PDCCH is a common downlink physical channel that is monitored by the UEs that are attached to a base station (BS). 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. *See e.g.,* EX-1006 (36.213), p. 66; EX-1009 pp. 11-12; *see also* EX-1003 ¶41.

The area allocated to the PDCCH (i.e., the number of Resource Elements—REs) the UE needs to monitor can vary from cell to cell based on the BS's bandwidth allocation. For at least this reason, the BS informs the UE of the total size of the PDCCH area and the specific control areas it needs to monitor to find its messages. These PDCCH search spaces are designated by the BS as either a "common" search space or a "UE-specific" search space. EX-1006 (36.213) p. 66. The common search space is comprised of an allocated area in multiple PDCCH channels that is monitored by a group of UEs in a cell, while the UE-specific search space is monitored by only a specific UE. *Id.* EX-1003 ¶¶42-44

The BS transmits 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. EX-1003 ¶44.

The process of the UE using the PDCCH configuration information sent to it in an RRC DCI configuration message to monitor the different PDCCH channels for messages and decoding them is referred to as "blind decoding." EX-1003 ¶45.

2. Blind Decoding of a PDCCH Using an RNTI

Blind Decoding of the PDCCH was routinely used in LTE 4G wireless communication systems years prior to the Priority Date. It is the process of the UE monitoring a set of PDCCH candidates to find the messages being transmitted from the BS and, once it finds a message, it determines if the message is intended for it and not another UE. The 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. 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 BS 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. EX-1003 ¶46.

To keep the control channel messages as short and 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 BS 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 BS using a special 16-bit code referred to as a **Radio Network Temporary Identifier** (RNTI) that the BS 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 BS based on the purpose of the message being sent. EX-1003 ¶47.

This CRC encoding and its subsequent scrambling with an RNTI value was described in the 4G LTE specification many years before the Priority Date. EX-1016 (36.212), p. 56. EX-1003 ¶48.

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) pp. 20, 66. EX-1003 ¶49.

Numerous prior art references describe this well-known "blind decoding" process, including the use of RNTIs to perform the decoding. For example, like the ’942 Patent, *Lyu* (EX-1010) is directed to a preemption notification and detection technique in a wireless 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. Similarly, *Lee* (EX-1011), which also addresses preemption techniques, explains:

> In 3GPP LTE, blind decoding is used to detect a PDCCH. Blind 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. Further, like the ’942 Patent, *Lee* 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. *Lee’s* FG-RNTI is an example of a special RNTI that can be assigned to a UE for a specific purpose. EX-1003 ¶¶50-52.

Consistent with the art, the ’942 Patent describes the “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 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. EX-1003 ¶¶53.

3. UE-Specific / Dedicated Mode RRC Signaling

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 Priority Date. 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 BS and a UE. The RRC DCI messages 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 known as dedicated signaling). EX-1003 ¶54.

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) configuration message. EX-1008 (36.331), pp. 41, 47, 48, 119 ("The IE *PhysicalConfigDedicated* is used to specify the UE specific physical channel configuration.") *see also* EX-1003 ¶54.

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)."); *see also* EX-1003 ¶55.

4. Common Search Space / Multicast Signaling

The use of multicast signaling also was routinely used long before the Priority Date. As explained above, the BS sends messages to a UE through either a UE-specific or a common search space. The BS uses 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 BS uses multicast signaling because the messages are from one BS to potentially many UEs, i.e., the group of UEs that are configured to receive messages through the common search space. EX-1003 ¶56-57; *see also, e.g.,* EX-1017, p. 846 ("Multicast is communication between a single device and multiple members of a device group.").

Multiple references in the art demonstrate that transmitting signals to a group of devices through a common search space (i.e., a multicast) to indicate preemption of resources was commonly practiced. For example, *Islam* 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 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. 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. EX-1003 ¶58.

Islam discloses 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. 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. EX-1003 ¶59.

As another example, *Lyu*, 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. 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. EX-1003 ¶60.

Further, the use of a "common search space" in a downlink control channel had been defined years before the Priority Date in the 4G LTE standard. That is, the 4G LTE standard defined 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. EX-1006 (36.213) p. 66; EX-1003 ¶61.

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. That is, 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) and messages sent through a common search space for receipt by the group of UEs configured to monitor the common search area of the PDCCH (i.e., multicast). EX-1006 (36.213) p. 21. EX-1003 ¶62.

5. Information Related to Time and Frequency

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 BS 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; EX-1003 ¶63.

Each subcarrier is 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 OFDMA. EX-1009, p. 5; EX-1003 ¶64.

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. EX-1003 ¶65.

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", which represents a time period across multiple subcarrier frequencies, is also commonly used. EX-1009, p. 6; EX-1003 ¶66.

VI. IDENTIFICATION OF CHALLENGES

A. Challenged Claims

This Petition challenges claims 1-3, 5-7, and 9-11 of the '942 Patent (the "Challenged Claims").

B. Statutory Grounds for Challenges

The Challenges are detailed below and summarized as follows:

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

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. *Kuchibhotla* qualifies as prior art under 35 U.S.C. § 102(a)(2).

United States Publication No. 2016/0234857 A1 to Chen et al. (EX-1005) ("*Chen*") was filed January 12, 2016 and published August 11, 2016. *Chen* qualifies as prior art under 35 U.S.C. § 102(a)(2).

VII. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

Ground 1 is that *Kuchibhotla* in view of the knowledge of a POSITA renders the Challenged Claims obvious. Ground 2 is that *Kuchibhotla* in view of *Chen* and further in view of the knowledge of a POSITA renders the Challenged Claims obvious.

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

1. Overview of *Kuchibhotla*

Like the '942 Patent, *Kuchibhotla* is directed to techniques and apparatuses 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 marker. The marker, which includes information identifying the preempted resources, can be sent after the re-allocation 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. EX-1003 ¶97.

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.

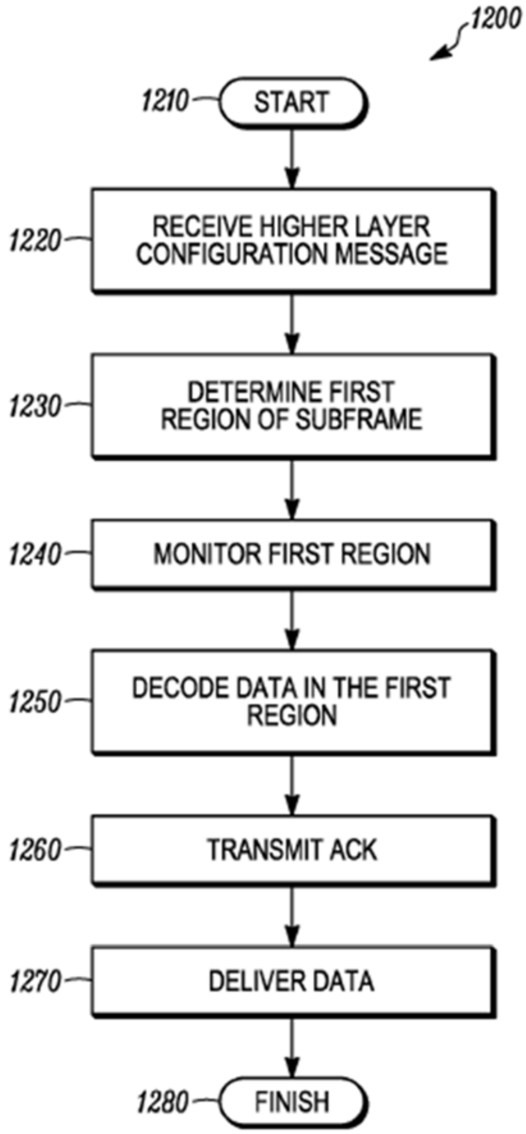


FIG. 12

EX-1004, FIG. 12; EX-1003 ¶98.

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; EX-1003 ¶99.

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; EX-1003 ¶100.

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 at cell admission, the UE also can be assigned special RNTIs. EX-1004, ¶¶47, 84, 108; EX-1003 ¶101.

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; EX-1003 ¶102.

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; EX-1003 ¶103.

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

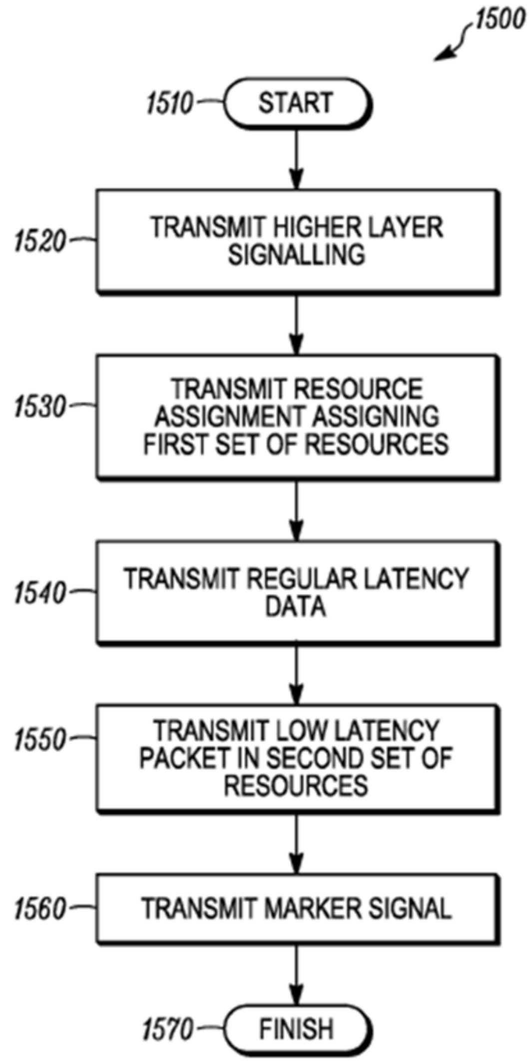


FIG. 15

EX-1004, FIG. 15; EX-1003 ¶104.

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 transmissions occur. 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; EX-1003 ¶105.

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; EX-1003, ¶106.

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

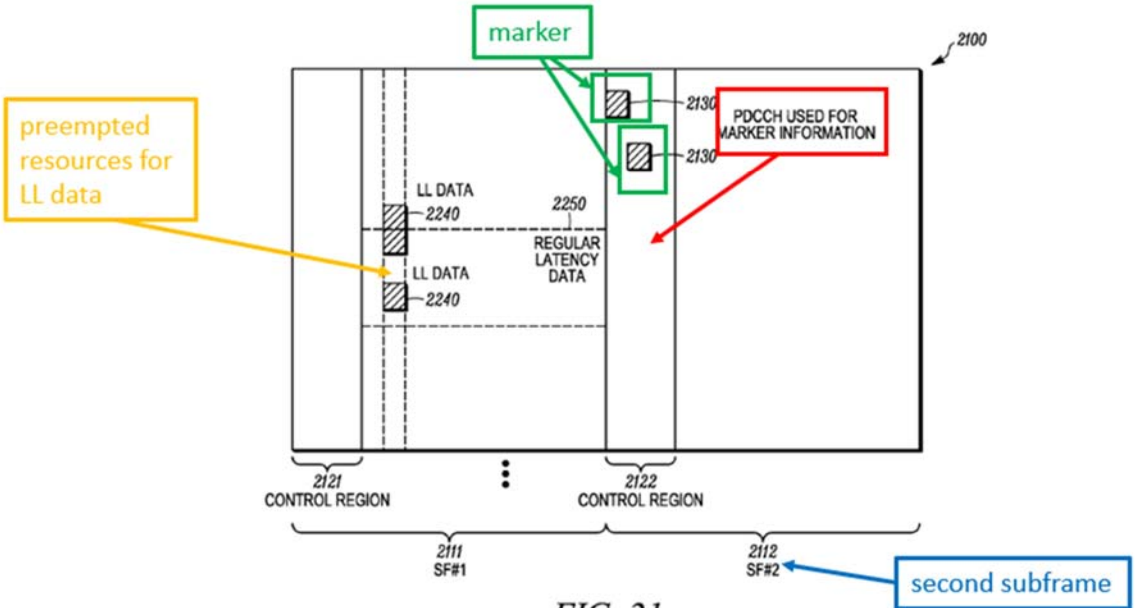


FIG. 21

EX-1004, FIG. 21 (annotated). EX-1003 ¶107.

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; EX-1003 ¶108.

2. Overview of *Chen*

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 ....

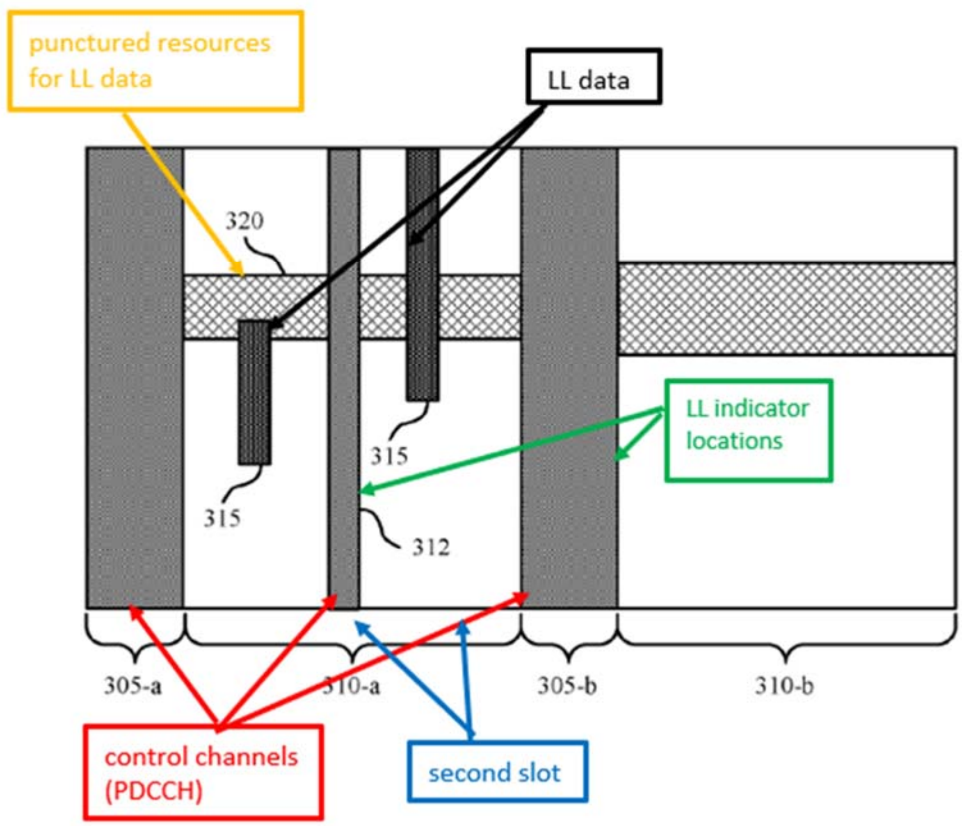
EX-1005, ¶57; EX-1003 ¶109.

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; EX-1003 ¶111.

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.



EX-1005, FIG. 3 (annotated). EX-1003 ¶112.

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; EX-1003 ¶113.

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. EX-1003 ¶115.

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

In this section, Petitioners primarily apply Ground 1 to the Challenged Claims and explicitly identify where Ground 2 sets forth a distinct application to the Challenged Claims. For the claim elements where Ground 2 is not explicitly discussed, the analysis for Ground 1 also applies to Ground 2.

a. <u>Claim 1</u>

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

To the extent the preamble is limiting, *Kuchibhotla* discloses[2] this claim element. EX-1003 ¶118.

Kuchibhotla discloses a user equipment (UE) device receiving downlink

[2] As used throughout this Petition, "discloses" encompasses what a reference would teach, suggest, or render obvious to a POSITA.

(DL) signals or messages from a base station (BS):

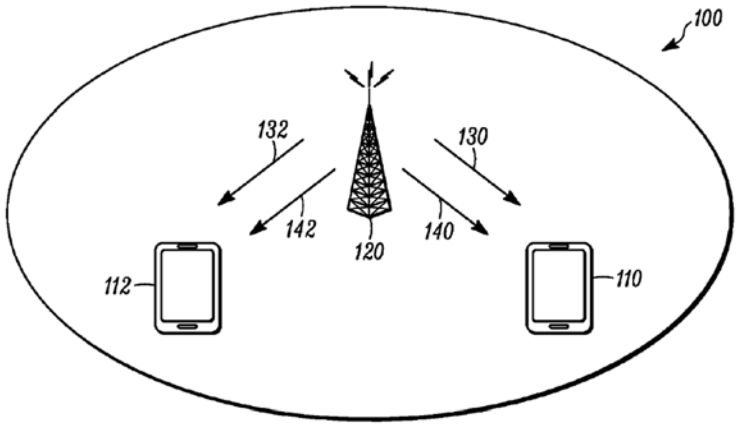


FIG. 1

EX-1004, FIG. 1.

> 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; EX-1003 ¶119.

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; EX-1003 ¶120.

Finally, *Kuchibhotla* discloses that a UE can receive a marker 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; EX-1003 ¶121.

To the extent the preamble is limiting, *Kuchibhotla* thus discloses "*a method of receiving a downlink (DL) signal by a first user equipment (UE).*" EX-1003 ¶122.

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;

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 the marker by assigning a specific RNTI 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 mask. EX-1003 ¶123.

a. <u>*Kuchibhotla's* **Marker** is "*DL Preemption Indication Information*"</u>

Kuchibhotla teaches the use of a marker to support the transmission of both low latency and regular latency transmissions in the same subframe. Like the '942 Patent, *Kuchibhotla* teaches that at least some of the resources assigned for regular latency transmissions can **overlap** with resources used for low latency transmission:

> 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; EX-1003 ¶124.

Because different types of traffic can be sent within overlapping resources in the same subframe, *Kuchibhotla* uses a **marker** to inform the 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. *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. EX-1003 ¶125.

Kuchibhotla's marker 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* marker is "*DL preemption indication information*." EX-1003 ¶126.

b. <u>*Kuchibhotla* Uses **Dedicated Mode** ("*UE-specific*") RRC Signaling to Assign to the UE a **Special RNTI** for Monitoring **PDCCH**</u>

Kuchibhotla further discloses that (1) higher layer UE-specific RRC messaging configures a UE (2) to monitor (blindly decode) a DL control channel

(3) through use of a 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. Thus, *Kuchibhotla* discloses that the UE receives a dedicated mode RRC message that configures the UE to monitor downlink control channel candidates through blind decoding. EX-1003 ¶127-128.

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)"). EX-1003 ¶129.

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.*" EX-1003 ¶130.

Third, *Kuchibhotla's* description of how a "**particular UE**" is configured to **monitor (blindly decode)** for a DL control channel confirms that the dedicated mode RRC configuration 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. *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.

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**) its PDCCH candidates is a disclosure of a "*specific RNTI*" that is "*received … through a UE-specific radio resource control (RRC) signaling*." EX-1003 ¶131-133.

c. <u>*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*")</u>

Kuchibhotla discloses an embodiment in which the special RNTI that is used for monitoring PDCCH candidates is a special CRC mask 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; FIG. 21. EX-1003 ¶134-135.

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 cell admission. The marker-RNTI is a *specific RNTI* assigned to the UE for the purpose of monitoring for a **marker** (*DL preemption indication information*) in **PDCCH** (*DL control channel*). To enable monitoring of PDCCH candidates 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** (*UE-specific*) RRC signaling. EX-1003 ¶136.

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 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. EX-1004, ¶84. EX-1003 ¶137.

A POSITA would have been motivated to include the marker-RNTI in the UE-specific RRC configuration signaling at cell admission in addition to or instead of the LL-RNTI for at least the reason that the marker-RNTI beneficially enhances the efficiency of monitoring PDCCH for control information. That is, because the marker-RNTI allows the UE to differentiate the marker from other control channel information, the UE can more efficiently identify resources that have been preempted for low latency transmissions. EX-1004, ¶84. EX-1003 ¶138.

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*) candidates for a marker (*DL preemption indication information*). *Kuchibhotla* discloses that the configuration message received by the particular UE includes a **unique/special identifier** (*specific RNTI*) assigned to that UE (**marker-RNTI**) that the UE can apply to PDCCH to decode a **marker** that identifies resources that have been used for low latency traffic (*specific RNTI for DL preemption indication information*). EX-1003 ¶139.

Kuchibhotla therefore discloses element [1.1]. EX-1003, ¶140.

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

For the reasons discussed above for element [1.1], *Kuchibhotla* discloses that the marker can be received on a *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 by applying its marker-RNTI as a mask. EX-1003, ¶141.

A POSITA reading *Kuchibhotla* would have understood that the marker-RNTI would be received by the UE prior to the UE monitoring PDCCH for the marker. As set out in the State of the Art section, the control channel monitoring technique described by *Kuchibhotla* cannot be performed unless the UE already has received a higher layer configuration message assigning the marker-RNTI that the UE is to use for blind decoding. *See* Section V.F.1-2, *supra.* EX-1003 ¶142.

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*). EX-1003 ¶143.

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

For element [1.3], Petitioners present separate arguments for Grounds 1 and 2.

<u>Ground 1</u>

Kuchibhotla discloses that the UE can receive the marker via a transmission common to multiple devices:

The **marker** transmission can be sent as **a broadcast transmission**

> **common to multiple devices**.

EX-1004, ¶76; EX-1003 ¶145.

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. 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. 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; 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."); EX-1003 ¶¶146-148.

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. 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*. EX-1003 ¶149.

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. During prosecution of the '942 Patent, this disclosure was understood to correspond to a *multicast signal.* EX-1002, 416-417; EX-1003 ¶150.

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 as a multicast message. For example, as discussed in the State of the Art section, the transmission of data puncturing or preemption indication information in a common search space (which is accessible to only a common group of UEs in the cell) was a well-known technique that makes efficient use of a network's communication resources. That is, designating a common search space for a common group of UEs in a cell is more efficient than assigning UE-specific search spaces to each UE. *See* §V.F.4, *supra.* EX-1003 ¶151.

Likewise, directing preemption information to only the group of 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 to only a group of common devices that would benefit from the transmission (e.g., UEs in the cell that can transmit data in the punctured resources) was a conventional and efficient design choice that a POSITA would be motivated to implement in *Kuchibhotla's* network with a predictable and reasonable expectation of success. EX-1003 ¶152.

Kuchibhotla thus discloses element [1.3]. EX-1003, ¶153.

<u>Ground 2</u>

Kuchibhotla in view of *Chen* renders element [1.3] obvious. EX-1003, ¶154.

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; EX-1003, ¶155.

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"). EX-1003, ¶156.

Thus, *Chen* discloses an **indicator** ("*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 subframe** ("*prior slot*"). EX-1003, ¶157.

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. EX-1003, ¶158.

Thus, *Chen* and *Kuchibhotla* are in the same field of endeavor, i.e., supporting both low latency and non-latency transmissions in the same subframe and providing notification of resources punctured for low latency data. A POSITA thus would have been motivated to look to *Chen's* teachings to use 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"); EX-1003, ¶159.

Further, a POSITA would have been motivated to multicast *Kuchibhotla's* marker 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. 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 is monitored 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*. EX-1003, ¶160.

Further, as demonstrated in the State of the Art section, sending preemption information in a common search area or to a common 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* §V.F.4, *supra.* EX-1015, ¶¶68, 75; EX-1010, ¶¶21, 22, 24; EX-1006, p. 21. EX-1003, ¶161.

Kuchibhotla in view of *Chen* thus renders obvious element [1.3]. EX-1003, ¶162.

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),

For reasons discussed above for element [1.1], *Kuchibhotla* discloses that the **marker-RNTI** (*specific RNTI*) is received 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]. EX-1003, ¶163.

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,

Ground 1

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"); EX-1003 ¶165.

Kuchibhotla also teaches a marker (*DL preemption indication information*) that "*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. *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. A POSITA reading *Kuchibhotla* would have understood that marker information identifying REs and RBGs within a UE's allocation that have been used for low latency transmissions is information "*indicat[ing] preempted resource information*." EX-1003 ¶166-167.

Kuchibhotla discloses that the marker 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+l) 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; EX-1003 ¶168.

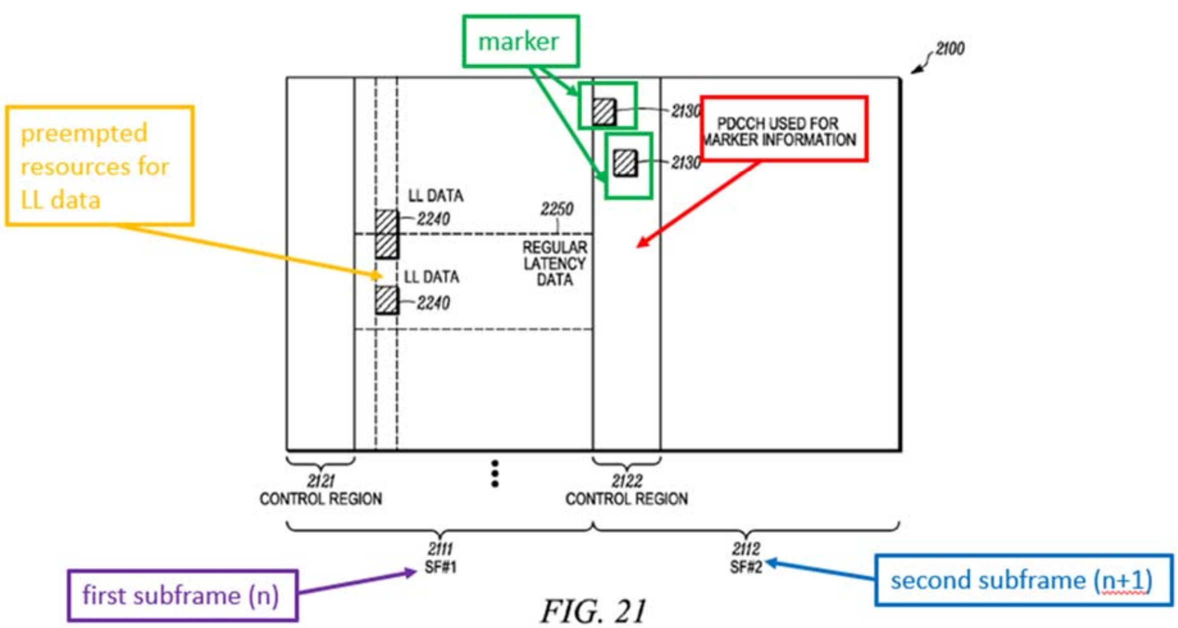


FIG. 21

EX-1004, FIG. 21 (annotated). *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; EX-1003 ¶¶168-169.

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]. EX-1003 ¶¶170-172.

Ground 2

1. *Kuchibholta* in view of *Chen* renders element [1.5] obvious. As described in Section VII.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. EX-1003 ¶174.

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. EX-1003, ¶175.

Kuchibhotla in view of *Chen* thus renders obvious element [1.5]. EX-1003, ¶176.

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

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. ...
>
> 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, ... successful 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. *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. EX-1003, ¶177-178.

Kuchibhotla discloses an embodiment in which information sent using PDCCH can include the marker. EX-1004, ¶84. In such embodiments, a special RNTI that the UE applies for monitoring PDCCH is the marker-RNTI. EX-1003 ¶179.

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, ¶131 ("A higher layer can indicate where the marker can be transmitted, such as which of different candidate marker locations is being used."). EX-1003 ¶180.

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. EX-1003 ¶181.

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* §V.F.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. EX-1003 ¶182.

Thus, a POSITA reading *Kuchibhotla* would have understood that the special RNTI assigned to the UE to monitor possible locations (*time/frequency information*) for the marker (i.e., marker-RNTI) is received in the higher layer configuration message with the possible marker locations that the UE should attempt to decode using the marker-RNTI. EX-1004, ¶¶36, 37, 47, 57, 62, 81, 82, 84, 105-108, 131, 135; *see also* §V.F.1-3, 5. EX-1003 ¶183.

Kuchibhotla thus discloses element [1.6]. EX-1003 ¶184.

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.

For the reasons discussed for element [1.6], *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. *Kuchibhotla* further discloses that the higher layer signaling can be dedicated mode RRC signaling (*UE-specific RRC signaling*). EX-1004, ¶¶47, 57; *see also* §VII.A.3.ii & vii, *supra.* EX-1003 ¶185.

Kuchibhotla thus discloses element [1.7]. EX-1003 ¶186.

b. Claim 2

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [2.0] for reasons discussed above for claim 1 in §VII.A.3.a.i. EX-1003 ¶188.

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.

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. 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. EX-1003 ¶189-190.

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:

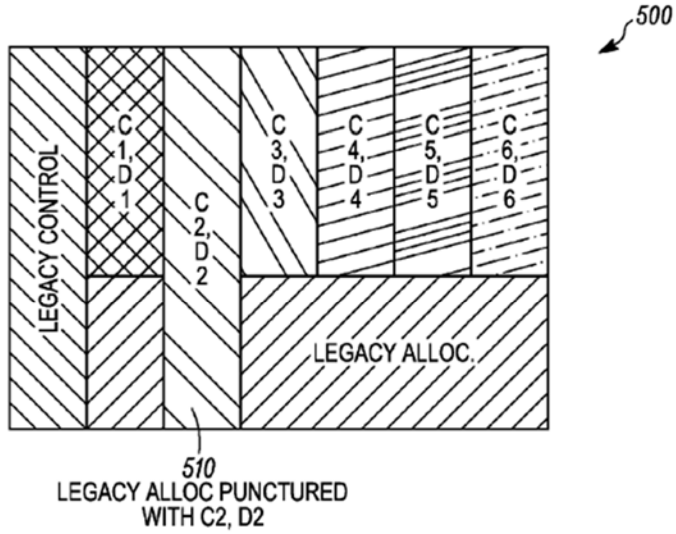


FIG. 5

EX-1004, FIG. 5. With reference to FIG. 5, *Kuchibhotla* discloses:

> 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. EX-1003 ¶¶191-192.

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 has a much longer *time-domain* allocation than the low latency transmissions. EX-1003 ¶193.

Kuchibhotla therefore discloses element [2.1]. EX-1003 ¶194.

c. <u>Claim 3</u>

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [3.0] for reasons discussed above for claim 1 in §VII.A.3.a. EX-1003 ¶195.

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

Kuchibhotla discloses that "information conveyed using the marker 2130 can be sent using control channels, such as PDCCH." EX-1004, ¶84. EX-1003 ¶196.

<u>Ground 1</u>

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* §VII.A.3.a.iv, *supra*; EX-1003, ¶197.

Kuchibhotla therefore discloses element [3.1]. EX-1003, ¶198.

Ground 2

Kuchibhotla in view of *Chen* renders element [3.1] obvious for at least the reasons discussed above for element [1.3] of Ground 2. *See* §VII.A.3.a.iv*, supra*; EX-1003, ¶199.

d. Claim 5

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

To the extent the preamble is limiting, *Kuchibhotla* discloses this element. As discussed with regard to element [1.0], *Kuchibhotla* discloses a user equipment (UE) device receiving downlink signals or messages from a base station (BS). *See* §VII.A.3.a.i*;* EX-1003, ¶¶200-201.

As further discussed above, *Kuchibhotla* also discloses that data, signals and messages are transmitted between the UE and the base station using assigned channels on a downlink and an uplink; and it discloses that a BS can transmit a marker signal to a UE on a downlink control channel. *See* §VII.A.3.a.i*;* EX-1003 ¶202-203.

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:

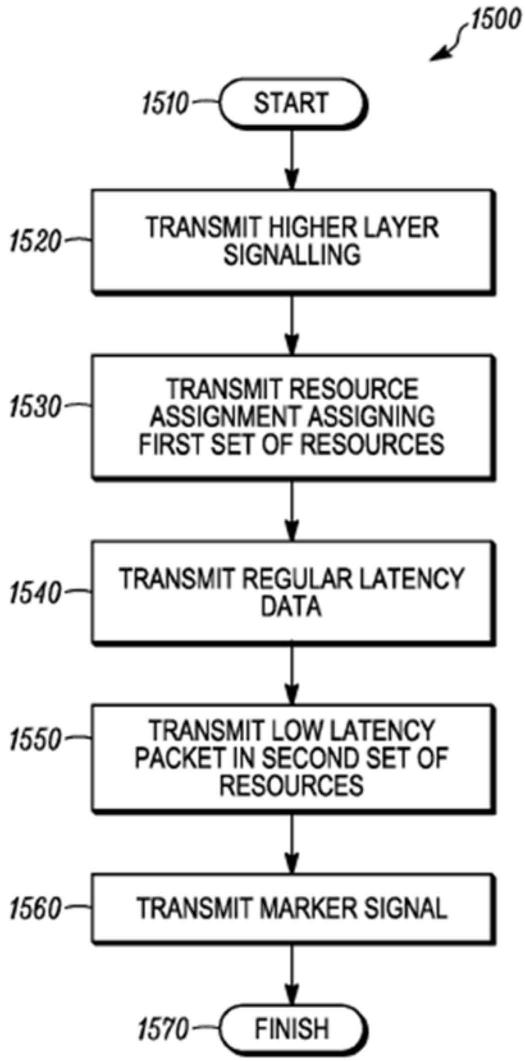


FIG. 15

EX-1004, FIG. 15. EX-1003 ¶204.

To the extent limiting, *Kuchibhotla* thus discloses element [5.0]; *see also* §VII.A.3.a.i, *supra*. EX-1003 ¶205.

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

Kuchibhotla discloses element [5.1] for the same reasons as set forth for elements [1.1] and [1.2]. *See* §VII.A.3.a.ii-iii; EX-1003 ¶206.

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***

Kuchibhotla discloses element [5.2] for the same reasons as set forth for element [1.1]. *See* §VII.A.3.a.ii; EX-1003 ¶207.

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

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* §VII.A.3.a.iii-iv; EX-1003 ¶208.

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);***

Kuchibhotla discloses element [5.4] for the same reasons as set forth for element [1.4]. *See* §VII.A.3.a.v; EX-1003 ¶209.

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,

Kuchibhotla or *Kuchibholta* in view of *Chen* renders obvious element [5.5] for the same reasons as set forth for element [1.5]. *See* §VII.A.3.a.vi; EX-1003 ¶210.

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

Kuchibhotla discloses element [5.6] for the same reasons as set forth for element [1.6]. *See* § VII.A.3.a.vii; EX-1003 ¶211.

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.

Kuchibhotla discloses element [5.7] for the same reasons as set forth for element [1.7]. *See* §VII.A.3.a.viii; EX-1003 ¶212.

e. <u>Claim 6</u>

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [6.0] for reasons discussed above for claim 5. *See* §VII.A.3.d; EX-1003 ¶213.

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.

Kuchibhotla discloses element [6.2] for the same reasons as set forth for element [2.1]. *See* §VII.A.3.b.ii; EX-1003 ¶214.

f. Claim 7

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [7.0] for reasons discussed above for claim 5. *See* §VII.A.3.d; EX-1003 ¶215.

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [7.1] for reasons discussed above for element [3.1] *See* §VII.A.3.c.ii; EX-1003 ¶216.

g. Claim 9

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

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* §VII.A.3.a.i; EX-1003 ¶217.

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

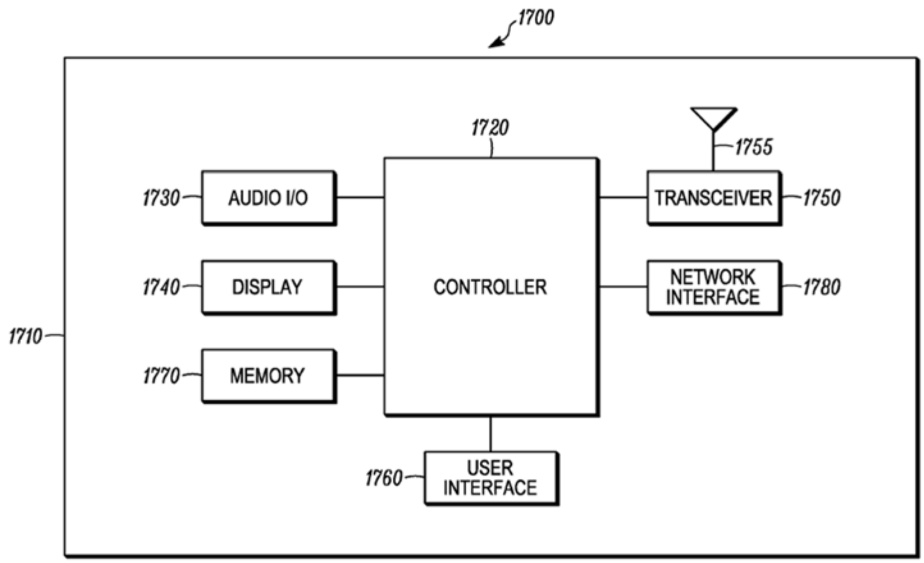


FIG. 17

EX-1004, FIG. 17. *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. EX-1003 ¶¶218-219.

Kuchibhotla therefore discloses element [9.0]. EX-1003 ¶220.

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;

Kuchibhotla discloses that transceiver 1750 "can include a transmitter and/or a receiver." EX-1004, ¶144. Further, *Kuchibhotla* discloses element [9.1] for the same reasons as set forth for element [1.1]. *See* §VII.A.3.a.ii; EX-1003 ¶¶221-222.

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,

Kuchibhotla discloses element [9.2] for the same reasons as set forth for element [1.2]. *See* §VII.A.3.a.iii; EX-1003 ¶223.

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [9.3] for reasons discussed above for element [1.3]. *See* §VII.A.3.a.iv; EX-1003 ¶224.

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),

Kuchibhotla discloses element [9.4] for the same reasons as set forth for element [1.4]. *See* §VII.A.3.a.v; EX-1003 ¶225.

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,

Kuchibhotla or *Kuchibholta* in view of *Chen* renders obvious element [9.5] for the same reasons as set forth for element [1.5]. *See* §VII.A.3.a.vi; EX-1003 ¶226.

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

Kuchibhotla discloses element [9.6] for the same reasons as set forth for element [1.6]. *See* §VII.A.3.a.vii; EX-1003 ¶227.

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.

Kuchibhotla discloses element [9.7] for the same reasons as set forth for element [1.7]. *See* §VII.A.3.a.viii; EX-1003 ¶228.

h. <u>Claim 10</u>

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [10.0] for the same reasons as set forth for claim 9. *See* §VII.A.3.g; EX-1003 ¶229.

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.

Kuchibhotla discloses element [10.1] for the same reasons as set forth for element [2.1]. *See* §VII.A.3.b.ii; EX-1003 ¶230.

i. <u>Claim 11</u>

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

Kuchibhotla or *Kuchibhotla* in view of *Chen* renders obvious element [11.0] for reasons discussed above for claim 9. *See* §VII.A.3.g; EX-1003 ¶231.

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

Kuchibhotla discloses or *Kuchibhotla* in view of *Chen* renders obvious element [11.1] for reasons discussed above for element [3.1]. *See* §VII.A.3.c.ii; EX-1003 ¶232.

VIII. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION AND DENY INSTITUTION

A. The Board Should Not Deny Institution Under 35 U.S.C. § 325(d)

Petitioners are unaware of any authority holding *Advanced Bionics* to be satisfied where (like here) the prosecution history lacks discussion of any reference relied upon in this petition. In such situations, the Board routinely does not decline institution on Section 325 grounds. Moreover, the challenges in this petition are non-cumulative because the prior art presented describes the claim limitations that were added to gain allowance. *See* §§V.B, VII.A.3.

B. The Board Should Not Deny Institution Under 35 U.S.C. § 314(a)

The Challenged Claims have never been tested against the most relevant prior art. In view of these strong and compelling challenges and the three separate district court proceedings, institution should not be discretionarily denied under §314(a). *See NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 19-20 (PTAB Sept. 12, 2018) (precedential); *Apple v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 13-14 (PTAB Mar. 20, 2020) (precedential).

Factor 1—a stay of the district court litigation— weighs against discretionary denial. In the district court litigation, counterclaim defendant and patent owner KT Corporation ("KT") has disputed jurisdiction. The parties are engaged in jurisdictional discovery, and the Court has granted KT a protective order from non-jurisdictional discovery during the jurisdictional discovery period. Ex. 1022. This could extend the district court trial date, which "allays concerns about inefficiency and duplication of efforts" in the PTAB. *Fintiv* at 8.

Factor 2—the district court trial date and the Board's statutory deadline—should be considered at least neutral because jury selection is far in the future and is not set to begin until at least September 8, 2025. Even if jury selection were to proceed on September 8, 2025, jury selection would proceed with respect to only one of the three cases (e.g., the Verizon case, the AT&T case, and the T-Mobile case). Each of the defendant Petitioners are entitled to separate trials, which will necessarily proceed on separate dates. As such, there are explicit and inherent uncertainties for this case given the number of parties involved and the number of trials regarding this patent. In addition, and because much can change in ten months, the current trial date does not support denial. *See Dish Network v. Broadband iTV*, IPR2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021) ("We cannot ignore the fact that the currently scheduled trial date is more than nine months away and much can change during this time").[3]

Moreover, given the existence of three cases each with multiple parties, to include multiple intervenors, the likelihood that any trials will be scheduled serially, the potential length of the trials given the number of patents at issue (11) and claims at issue, and post-trial motions, it is likely that the district court proceedings will not be complete before the final written decision in this matter. Indeed, these cases additionally will likely be delayed (as explained earlier) because counterclaim defendant and patent owner KT has disputed jurisdiction, has yet to file an Answer,

[3] The "statistics on median time-to-trial for civil actions in the district court in which the parallel litigation resides" do not apply to this case given the number of cases and defendants.

and the Court has granted KT a protective order from non-jurisdictional discovery. EX-1022.

Altogether, this factor weighs against discretionary denial.

Factor 3—investment in the district court proceedings—weighs against discretionary denial. The district court cases are in their early stages and the district court has not issued any substantive rulings in either case with respect to the ’942 patent. Infringement contentions were served on March 18, 2024, invalidity contentions were served on May 17, 2024, and the claim construction hearing is not scheduled until March 11, 2025. EX-1020. In addition, counter-claim defendant and patent owner, KT Corporation has not yet filed an answer, which will likely further delay progress on the merits.

Altogether, there is much work to be done in the district court and most, if not all, of the work will be well in the future. Accordingly, the district court will not invest significant resources related to the challenged patent prior to an institution decision. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12; *DISH Network*, IPR2020-01280, Paper 17 at 18-21.

Factor 4—overlap between this proceeding and the district court proceedings—favors institution. Indeed, there will not be complete overlap between this IPR and the district court cases because there are nine ‘942 patent claims asserted in this case and a total of 113 asserted for all patents in the related district court cases. The district court will likely reduce the asserted claims prior to trial, including some of the claims at issue here. This factor thus weighs against the Board exercising its discretion to deny.

Factor 5—overlapping parties—is neutral as it is "far from an unusual circumstance that a petitioner in *inter partes* review and a defendant in a parallel district court proceeding are the same." *Sand Revolution*, IPR2019-01393, Paper 24 at 12-13.

Factor 6—other considerations—weighs strongly against discretionary denial. As detailed herein, this is a compelling case, and the merits of the Petition are strong. For example, *Kuchibhotla* alone, as well as *Kuchibhotla* in view of *Chen*, expressly disclose limitations [1.6] and [1.7] (as well as similar limitations [5.6]/[5.7], and [9.6]/[9.7]) which the Applicant incorporated into independent Claims 1, 5, and 9 to overcome prior art. *See* §§VII.A.3.a.vii-VII.A.3.a.vii; VII.A.3.d.vii-VII.A.3.d.vii; VII.A.3.g.vii-VII.A.3.g.vii; V.B. Moreover, none of the grounds asserted herein were previously considered by either the Office or the district courts. *Cf. Comcast Cable Commn's, LLC v. Rovi Guides, Inc*., IPR2019-00231, Paper 14 at 11 (PTAB May 20, 2019) (obviousness challenges not "previously considered by the Office or any court" weigh in favor of not denying institution). Moreover, the '942 patent is currently asserted in three district court cases. Institution of this IPR provides the opportunity for narrowing and simplifying the litigations for the district court.

IX. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties in interest are Cellco Partnership d/b/a Verizon Wireless, Verizon Business Network Services LLC, Verizon Corporate Services Group Inc., TracFone Wireless, Inc., AT&T Corp., AT&T Services, Inc., AT&T Mobility LLC, AT&T Mobility II LLC, New Cingular Wireless PCS, LLC, Cricket Wireless LLC, T-Mobile, USA, Inc., Sprint Solutions LLC, Sprint Spectrum LLC, Ericsson Inc., Telefonaktiebolaget LM Ericsson, Google LLC,[4] and Nokia of America Corporation.[5]

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[4] Google LLC is a subsidiary of XXVI Holdings Inc. which is a subsidiary of Alphabet Inc. XXVI Holdings Inc. and Alphabet Inc. are not real parties-in-interest to this proceeding.

[5] Out of an abundance of caution, Petitioners have identified all current defendants in the below cases, as well as additional involved parties, as potential real parties in interest only for the purpose of this proceeding and only to the extent that Patent Owner contends that these separate legal entities should be named real parties in interest in this IPR. Petitioners do so to avoid the potential expenditure of resources to resolve such a challenge. Petitioners also acknowledge that each

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Judicial Matters

As of the filing date of this Petition, the ’272 patent is currently asserted in three pending district court cases:

- *Pegasus Wireless Innovation LLC. v. AT&T Inc. et al.*, No. 2:23-cv-00638 (E.D. Tex) (hereafter, “AT&T Case”);
- *Pegasus Wireless Innovation LLC. v. T-Mobile US, Inc. et al.*, No. 2:23-cv-00639 (E.D. Tex) (hereafter, “T-Mobile Case”); and
- *Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.*, No. 2:23-cv-00640 (E.D. Tex) (hereafter, “Verizon Case”).

The above cases, which include defendants AT&T, T-Mobile, and Verizon and intervenors Nokia and Ericsson, have been consolidated into the Verizon Case for all pretrial issues. EX-1021. The district court cases are in their early stages and the district court has not issued any substantive rulings in either case with respect to the ’942 patent.

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petitioner has a number of affiliates. No unnamed entity is funding, controlling, or otherwise has an opportunity to control or direct this Petition or Petitioners’ participation in any resulting IPR. Petitioners are also not aware of any affiliate that would be barred from filing this Petition under 35 U.S.C. § 315(e).

Petitioners are not aware of any other judicial or administrative matter that would affect or be affected by a decision in this IPR.

C. Related Patents

Petitioners are unaware of any related patents.

D. Lead/Back-up Counsel (37 C.F.R. § 42.8(b)(3)):

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E. Notice of Service Information (37 C.F.R. § 42.8(b)(4)):

Please direct all correspondence to lead and back-up counsel at the above addresses. Petitioners consent to electronic service at the email addresses above.

X. CONCLUSION

Petitioners request the Board institute IPR and cancel the Challenged Claims.

Respectfully submitted,

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Dated: December 24, 2024

CERTIFICATION OF SERVICE ON PATENT OWNER

Pursuant to 37 C.F.R. §§ 42.6(e), 42.8(b)(4) and 42.105, the undersigned certifies that on the 24th of December, 2024, a complete and entire copy of this Petition for *Inter Partes* Review of U.S. Patent No. 11,405,942 and all supporting exhibits were served via email and/or electronic download by agreement of Patent Owner, to the following address:

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24 *et seq*., the undersigned certifies that this document complies with the type-volume limitations. This document contains 13,924 words as calculated by the "Word Count" feature of Microsoft Word 2016, the word processing program used to create it. In addition, there were 35 words added to the annotated Figures herein as counted manually.

Dated: December 24, 2024

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