

***Expert Declaration of Mark R. Lanning In Support of
Petition for Inter Partes Review of U.S. Patent No. 10,181,931***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

PEGASUS WIRELESS INNOVATION LLC,
Patent Owner.

U.S. PATENT NO. 10,181,931

Title: METHOD FOR UPLINK CONTROL CHANNEL RESOURCE
ALLOCATION OF TERMINAL AND APPARATUS THEREOF

Inter Partes Review No.: IPR2025-00138

**DECLARATION OF MARK R. LANNING IN SUPPORT OF PETITION
FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,181,931**

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Petition for Inter Partes Review of U.S. Patent No. 10,181,931***

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- downlink data, and configured to receive the
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- iii. [5.2] a controller configured to determine a
resource allocated to the uplink control
channel for transmitting the response
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least one of i) information on a resource of a
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- vi. [5.5] wherein a plurality of pieces of start
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information are received through cell-
specific high layer signaling for the TC
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- vii. [5.6] wherein the start offset information on
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level; and 176
- viii. [5.7] wherein when the response information
of the downlink data of the MTC terminal is
repeatedly transmitted, the repeated
transmission is performed using a same
uplink control channel resource in each

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iii.	[7.2] wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;	180
iv.	[7.3] wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the informa-tion on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel;	180

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v.	[7.4] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;.....	181
vi.	[7.5] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;	181
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<i>Exhibit #</i>	<i>Description</i>
1001	U.S. Patent No. 10,181,931 (the “’931 Patent”)
1002	Prosecution history of the ’931 Patent (“File History”)
1003	Declaration of Petitioners’ Expert Dr. Mark Lanning
1004	U.S. Patent No. 11,470,619 (“Lee”)
1005	U.S. Provisional Application No. 61/863,328 (“Lee ’328”)
1006	International Patent Publication WO 2014/048487 (“Zhang”)
1007	3GPP TS 36.213 v.11.3.0 (“36.213”)
1008	ZTE, “Discussion on Repetition for Control Channel and Traffic Channel”, R1-133062, 3GPP TSG RAN WG1 Meeting #74 (August 2013) (“ZTE”)
1009	U.S. Publication No. 2014/0105191 (“Yang”)
1010	U.S. Publication No. 2016/0127952 (“You”)
1011	Certified Translation of U.S. Provisional Application No. 61/843,456 (“You ’456”)
1012	Certified Translation of International Patent Publication WO 2013/027963 (“Kim”)
1013	Certified Translation of International Patent Publication WO/2014/204128 (“You PCT”)
1014	International Patent Publication WO/2015/021318 (“Lee PCT”)
1015	Curriculum Vitae of Petitioner’s Expert Dr. Mark Lanning
1016	3GPP TS 36.211 v.11.3.0 (“36.211”)
1017	U.S. Provisional Application No. 61/843,456
1018	International Patent Publication WO/2014/204128

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<i>Exhibit #</i>	<i>Description</i>
1019	International Patent Publication WO 2013/027963
1020	3GPP TS 36.212 v.11.3.0 (“36.212”)
1021	U.S. Patent Application Publication No. 2014/0098761 (“Lee ’761”)
1022	U.S. Provisional Application No. 61/843,456
1023	International Patent Publication WO 2013/027963
1024	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 150
1025	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 68
1026	<i>Pegasus Wireless Innovation LLC. v. Verizon Communications Inc. et al.</i> , No. 2:23-cv-00640 (E.D. Tex) Dkt. 16

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I, Mark R. Lanning, declare as follows:

I. INTRODUCTION

1. My name is Mark R. Lanning, and I have been retained by the Petitioners to offer technical opinions relating to U.S. Patent No. 10,181,931 (“the ’931 Patent”) and prior art references relating to its subject matter. My extensive experience with cellular networks and their standards provides me with an understanding of the subject matter described and claimed in the ’931 Patent.

2. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the ’931 Patent. Any figures that appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the ’931 Patent and the prior art discussed below.

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

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

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

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5. Further details on my education, work experience, and the cases in which I have previously given testimony in the past four years are contained in my curriculum vitae (CV). Ex. 1015.

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

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

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

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

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

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

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

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

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

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

15. I was retained as a technical expert by Cellco Partnership d/b/a Verizon Wireless, AT&T Services, Inc., T-Mobile USA, Inc., Google LLC, Ericsson, Inc. and Nokia of America Corporation (collectively “Petitioners”).

III. DOCUMENTS AND OTHER MATERIALS REVIEWED

16. In forming the opinions set forth in this declaration, I have reviewed the documents Identified in the Exhibit List and the prosecution history of the ‘931 Patent and of the patents and patent applications to which it claims priority.

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17. Additionally, I have utilized my own experience and expertise, including that regarding the knowledge and capabilities of a person of ordinary skill in the relevant art in the timeframe of the claimed priority date of the '931 Patent.

IV. UNDERSTANDING OF THE LAW

A. Date of Invention

18. I have been asked to use the date of September 9, 2013, as the date of invention for purposes of my analysis ("priority date").

B. Obviousness

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

20. I am informed by Counsel and understand that a patent claim is invalid under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a person having ordinary skill in the art ("POSITA") to which the subject matter pertains. Obviousness, as has been explained to me, is based on (i) the scope and content of the prior art, (ii) the differences between the prior art and the

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claim, (iii) the level of ordinary skill in the art, and (iv) any secondary indicia of non-obviousness (e.g., “secondary considerations” such as commercial success in the marketplace of the claimed invention), to the extent that they exist.

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

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of a known technique to improve similar devices (methods, or products) in the same way;
- Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- Applying a technique or approach that would have been obvious to try (choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success);
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or

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other market forces if the variations would have been predictable to a person having ordinary skill in the art; and

- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

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

23. I further understand that a person of ordinary skill in the art is a hypothetical person who is presumed to be aware of all the relevant art at the time of the invention. The person of ordinary skill is not an automaton and may be able to fit together the teachings of multiple patents and/or printed publications employing ordinary creativity and the common sense that familiar items may have uses in another context or beyond their primary purposes.

24. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine

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the references exists to avoid impermissibly applying hindsight when combining or modifying the prior art. I understand this test should not be applied rigidly, but that the test can be important to avoid such hindsight.

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

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

C. Standard of Proof

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

V. LEVEL OF ORDINARY SKILL

28. I have considered the level of ordinary skill in the art relevant to the '931 Patent. I understand that factors such as the education level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, the prior art solutions to those problems, and the speed at which innovations are made may help establish the level of skill in the art.

29. After reviewing the '931 Patent, the relevant portions of the prosecution history of the '931 Patent, and the cited references, it is my opinion that the relevant art of the '931 Patent is in the general field of wireless communication systems, and

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more specifically, it is focused on some of the functionality used in Long Term Evolution (LTE) 4G cellular networks. *See e.g.*, Ex. 1001, 3:63-4:6.

30. Specifically, the '931 Patent relates to allocating resources for an uplink control channel for transmitting a Hybrid Automatic Repeat Request (HARQ) acknowledgement (ACK) or negative acknowledgement (NACK). Ex. 1001, 1:18-22. The '931 Patent is directed to providing a modified means of determining a PUCCH resource for sending an HARQ ACK/NACK response specifically by a machine type communication ("MTC") terminal. MTC terminals are low capability terminals, which have low performance hardware and software compared to a typical LTE/LTE-Advanced terminal. Ex. 1001, 7:13-16, 7:25-36, and 7:52-62.

31. Based upon my knowledge of this field, I conclude that a POSITA at the time of the alleged invention of the '931 Patent (September 2013), and for that matter, at all subsequent times through the present, would have been familiar with wireless communications networks, equipment, and integrated circuit chips, and would have had at least a working knowledge of the communication protocols issued by 3GPP. A POSITA would have had a bachelor's degree in electrical engineering, computer engineering, or a related discipline, knowledge of the relevant 3GPP standards as of this time, and at least 2 years of experience working in a field involving wireless communications.. A person with a different degree but with additional relevant experience could still qualify if the additional experience

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compensates for the different educational background. A person with less than 2 years of experience working in a field involving wireless communications could still qualify if the person has additional education that compensates for their lesser experience.

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

VI. RELEVANT TECHNOLOGY BACKGROUND

A. The 3GPP Standards Organization

33. The 3GPP is a standards-setting organization. As cellular telecommunications technology developed in the late 1980s, network operators recognized that standardization was necessary to ensure subscriber mobility and compatibility of equipment provided from multiple suppliers. Thus, the 3GPP began in 1998 when the European Telecommunications Standards Institute (ETSI) and other standard development organizations, as well as several telecommunications companies, formed a partnership to develop and standardize various aspects of 2G, 3G, and 4G mobile network operator systems.

34. The 3GPP is a group enterprise. Within the larger 3GPP umbrella are four primary plenary Technical Specification Groups (“TSGs”) (e.g., the Systems

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and Architecture (“SA”) group), under which are several working groups (e.g., Systems and Architecture Working Group 2 (“SA-2” or “S2”)). The meetings for each plenary and working group are numbered sequentially (e.g., TSG RAN WG1, Meeting #40; TSG RAN WG1, Meeting #41).¹ In my experience, the working groups met roughly every month in the September 2013 timeframe and were responsible for drafting and editing specific standards and change requests. All change requests had to be approved by the plenary group before the change requests were incorporated into a specific release of the standard.

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

36. Standardization by the 3GPP at the time of the ‘931 Patent was a collaborative effort and remains so today regarding new generations and Releases. It involves hundreds of engineers from companies that are interested in developing the technology. Each 3GPP working group typically holds monthly meetings in different locations around the world. The members of the working group submit written contributions (called “temporary documents” or “Tdocs”) and discussion documents. In my experience, the 3GPP has stored and controlled documents

¹ RAN stands for Radio Access Network.

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electronically, and these documents are retained on the public 3GPP server indefinitely. *See also* Ex. 1017, at pp. 2-3.

37. In my experience, the general practice of the 3GPP, both now and at the time of the invention, is to make Tdocs and discussion documents publicly available prior to each meeting. Then at the meeting itself, the members publicly discuss those Tdocs and discussion documents. Members also vote on the Tdocs and, if approved, incorporate them into the standard. *See also* Ex. 1017 at p. 1. Sometimes Tdocs are drafted, edited, or combined during the meeting. The new and edited Tdocs are given new Tdoc numbers and uploaded to the public 3GPP file server, usually soon after the meeting. Sometimes, the new and edited Tdocs are further circulated for e-mail approval—that is, they can be distributed and voted upon via e-mail.

38. In my experience, both now and at the time of the ‘931 Patent, Tdocs and discussion documents are publicly circulated to group members before and after meetings in two ways. First, they can be uploaded to the public 3GPP file server prior to each meeting. *See also* Ex. 1017. If so, the file will receive a date and time stamp. In my experience, the date and time stamp can be relied upon to indicate when the upload occurred, making the document available to the public on the Internet. *See* Ex. 1015, *Delegates Corner*. Second, Tdocs and discussion documents can be distributed to the public using the group’s public e-mail exploder. *See, e.g.,* Ex. 1016 at p. 1 “Questions about 3GPP email exploder lists.”

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B. The 3GPP 4G LTE Network Standard

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

C. The Relevant Physical LTE Channels

1. The PDDCH/EPDDCH Downlink Channels

40. The Physical Downlink Control CHannel (PDCCH) and the Enhanced Physical Downlink Control CHannel (EPDCCH) are both downlink control channels transmitted from the base station (eNodeB) to the UE (e.g., MTC terminal). They are used to transfer control information to the UEs in a cell. This control information includes scheduling information required for a UE to receive the PDSCH (described below) and for scheduling grants enabling the UE to transmit on the PUSCH (described below). The PDCCH/EPDCCH were defined by the 3GPP Technical Specification 36.211 v. 11.4.0 (Ex. 1016) (“36.211”), which was published and publicly available before September 20, 2013.

41. The PDCCH and EPDCCH channels are effectively the same in regard to the relevant functionality covered by this declaration so they can be used

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interchangeably. The starting number of the Control Channel Element (“CCE”) used by the base station (eNodeB) to transmit the PDCCH/EPCCCH is important for this declaration because it is used by the UE as one of the methods to determine the starting CCE it should use for transmitting its uplink PUCCH as described below.²

6.8 Physical downlink control channel

6.8.1 PDCCH formats

The physical downlink control channel carries scheduling assignments and other control information. A physical control channel is transmitted on an aggregation of one or several consecutive control channel elements (CCEs), where a control channel element corresponds to 9 resource element groups. The number of resource-element groups not assigned to PCFICH or PHICH is N_{REG} . The CCEs available in the system are numbered from 0 to $N_{\text{CCE}} - 1$, where $N_{\text{CCE}} = \lfloor N_{\text{REG}} / 9 \rfloor$. The PDCCH supports multiple formats as listed in Table 6.8.1-1. A PDCCH consisting of n consecutive CCEs may only start on a CCE fulfilling $i \bmod n = 0$, where i is the CCE number.

Multiple PDCCHs can be transmitted in a subframe.

Table 6.8.1-1: Supported PDCCH formats

PDCCH format	Number of CCEs	Number of resource-element groups	Number of PDCCH bits
0	1	9	72
1	2	18	144
2	4	36	288
3	8	72	576

Ex. 1016 (36.211) p. 77 (highlighting added).

6.8A Enhanced physical downlink control channel

6.8A.1 EPDCCH formats

The enhanced physical downlink control channel (EPDCCH) carries scheduling assignments. An enhanced physical downlink control channel is transmitted using an aggregation of one or several consecutive enhanced control channel elements (ECCEs) where each ECCE consists of multiple enhanced resource element groups (EREGs), defined in clause 6.2.4A. The number of ECCEs used for one EPDCCH depends on the EPDCCH format as given by Table 6.8A.1-2 and the number of EREGs per ECCE is given by Table 6.8A.1-1. Both localized and distributed transmission is supported.

Ex. 1016 (36.211) p. 79.

² Also see e.g., Ex. 1001 6:40-61 for admitted 3GPP CCE and CCE index definitions.

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42. The PDCCH/EPDCCH carries a control message to the UEs referred to as Downlink Control Information (DCI). A DCI message has multiple formats that are used depending on the set of information to be communicated to the UE. Each DCI message has multiple fields that are used to carry predefined information. The DCI control information, *inter alia*, specifies where the UE can find and decode its data being transmitted on the PDSCH. The DCI can also define the starting offset that a UE should use for its HARQ ACK/NACK transmission on the PUCCH.

43. The 3GPP TS 36.212 v.11.3.0 Specification (Ex. 1020) (“36.212”), which was also published and publicly available before September 20, 2013, defined the PDCCH DCI message and the formats as shown below. The 36.212 defines 14 different DCI formats. I have only included a portion of the description for Format 0 below as an example. Format 0 is mainly used to allocate PUSCH resources to the UE for it to send data.

5.3.3 Downlink control information

A DCI transports downlink or uplink scheduling information, requests for aperiodic CQI reports, notifications of MCCH change [6] or uplink power control commands for one cell and one RNTI. The RNTI is implicitly encoded in the CRC.

Ex. 1020 (36.212) p. 59.

5.3.3.1 DCI formats

The fields defined in the DCI formats below are mapped to the information bits a_0 to a_{A-1} as follows.

Id.

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5.3.3.1.1 Format 0

DCI format 0 is used for the scheduling of PUSCH in one UL cell.

The following information is transmitted by means of the DCI format 0:

Id.

44. The procedure for the UE receiving the PDCCH channel with different DCI formats was also defined as follows by 36.213.

7.1 UE procedure for receiving the physical downlink shared channel

Except the subframes indicated by the higher layer parameter *mbsfn-SubframeConfigList* of serving cell *c*, a UE shall

- upon detection of a PDCCH of the serving cell with DCI format 1, 1A, 1B, 1C, 1D, 2, 2A, 2B, 2C, or 2D intended for the UE in a subframe, or
- upon detection of an EPDCCH of the serving cell with DCI format 1, 1A, 1B, 1D, 2, 2A, 2B, 2C, or 2D intended for the UE in a subframe

decode the corresponding PDSCH in the same subframe with the restriction of the number of transport blocks defined in the higher layers.

Ex. 1007 (36.213) p. 29.

2. The PDSCH Downlink Channel

45. The Physical Downlink Shared CHannel (PDSCH) is used by the base station (eNodeB) to transmit data and other control information to multiple UEs, as the “shared” in its name implies. The PDSCH is defined by 36.211 as follows:

6.4 Physical downlink shared channel

The physical downlink shared channel shall be processed and mapped to resource elements as described in clause 6.3 with the following additions and exceptions:

Ex. 1016 (36.211) p. 73.

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3. The PUCCH Uplink Channel

46. The Physical Uplink Control CHannel (PUCCH) carries uplink control information. One relevant type of control information a UE sends is referred to as a Hybrid-ARQ acknowledgement (HARQ ACK/NACK), which indicates to base station (eNodeB) whether the data the UE received on the PDSCH was successfully received or not. Another type of control information transmitted by the UE on the PUCCH is a request for uplink resources to send data. As shown in the table below, the PUCCH can be transmitted using different formats, which define the modulation scheme being used by the UE and the resulting number of bits per subframe that are being transmitted. The PUCCH was defined by 36.211 as follows:

5.4 Physical uplink control channel

The physical uplink control channel, PUCCH, carries uplink control information. Simultaneous transmission of PUCCH and PUSCH from the same UE is supported if enabled by higher layers. For frame structure type 2, the PUCCH is not transmitted in the UpPTS field.

The physical uplink control channel supports multiple formats as shown in Table 5.4-1. Formats 2a and 2b are supported for normal cyclic prefix only.

Table 5.4-1: Supported PUCCH formats

PUCCH format	Modulation scheme	Number of bits per subframe, M_{bit}
1	N/A	N/A
1a	BPSK	1
1b	QPSK	2
2	QPSK	20
2a	QPSK+BPSK	21
2b	QPSK+QPSK	22
3	QPSK	48

Ex. 1016 (“36.211”), p. 24.

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D. HARQ ACK/NACK Scheduling On the PUCCH

47. By September 2013, scheduling a HARQ ACK/NACK uplink channel was also defined by the 3GPP and well known. The 3GPP defined the global technical specifications for HARQ ACK/NACK procedures. These standards are used by equipment manufacturers – both for network equipment, such as base stations (“BS”), and end-user devices, referred to as user equipment (“UE”) – to ensure that the devices may communicate with one another. The 3GPP-defined procedure for allocating a HARQ ACK/NACK uplink channel was well established before September 2013. For example, 3GPP Technical Specification 36.213 v. 11.4.0 (EX. 1007) (“36.213”), which was published and publicly available before September 20, 2013, provides a set of standard procedures for allocating PUCCH resources for the transmission of HARQ ACK/NACK.

48. Specifically, 36.213 defines a method for the terminal (UE) to calculate its PUCCH resource for sending an HARQ ACK/NACK in response to data it receives on the PDSCH downlink channel as indicated by its detection of a corresponding PDCCH/EPDCCH from the base station. EX. 1007 (36.213), Sections 10.1.2, 10.1.2.1, 10.1.3 and 10.1.3.1. Section 10.1.2 is in regard to Frequency Division Duplex (FDD) operation and Section 10.1.3 is in regard to Time Division Duplex (TDD) operation. Ex. 1020 (36.212), p. 7. The terminal uses the disclosed method to determine its PUCCH resource by utilizing a starting offset

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($N^{(1)}_{\text{PUCCH}}$) that is specified by higher signaling and the number of the first CCE used for transmission of the corresponding PDCCH (n_{CCE}). EX. 1007 (36.213), Section 10.1.3.1.

49. The 36.213 Specification further defines another method for the UE to determine the PUCCH resource it should use when sending an HARQ ACK/NACK in response to data it receives on the PDSCH. For FDD operation of one serving cell, the HARQ ACK/NACK resource offset (ARO) is received in a EPDCCH DCI field of the RRC signaling message as described by the table below.

**Table 10.1.2.1-1: Mapping of ACK/NACK Resource offset Field
in DCI format 1A/1B/1D/1/2A/2/2B/2C/2D to Δ_{ARO} values**

ACK/NACK Resource offset field in DCI format 1A/1B/1D/1/2A/2/2B/2C/2D	Δ_{ARO}
0	0
1	-1
2	-2
3	2

Ex. 1007 (36.213), Table 10.1.2.1-1, p. 142.

50. For, TDD operation of one serving cell, the HARQ ACK/NACK resource offset (ARO) is received in a EPDCCH DCI field as described by the table below.

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Table 10.1.3.1-2: Mapping of ACK/NACK Resource offset Field in DCI format 1A/1B/1D/1/2A/2/2B/2C/2D to Δ_{ARO} values for TDD when $m > 0$

ACK/NACK Resource offset field in DCI format 1A/1B/1D/1/2A/2/2B/2C/2D	Δ_{ARO}
0	0
1	$-\sum_{i=0}^{m-1} N_{ECCE,q,n-k_{i1}} - 2$
2	$-\sum_{i=1=m-\lceil m/3 \rceil}^{m-1} N_{ECCE,q,n-k_{i1}} - 1$
3	2

Ex. 1007 (36.213), Table 10.1.3.1-2, p. 151.

51. The 3GPP TS 36.213 specification also discloses a procedure for the UE to transmit the HARQ ACK/NACK message repeatedly using the same PUCCH resource. Ex. 1007 (36.213), Section 10.1.4. A UE-specific parameter, *ackNackRepetition*, is configured by higher layers and, when enabled, it directs a UE to repeat any HARQ ACK/NACK transmission with a repetition factor (N_{ANRep}), also provided by higher layers. Ex. 1007 (36.213), Section 10.1.4. For a HARQ ACK/NACK response to a PDSCH indicated by a corresponding PDCCH/EPDCCH, the initial HARQ ACK/NACK is transmitted to a PUCCH resource as determined by the method described above and the $N_{ANRep}-1$ repetitions are always transmitted on a single PUCCH resource, $n^{(1,p)}_{PUCCH,ANRep}$, which is signaled by higher layers as described below.

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10.1.4 HARQ-ACK Repetition procedure

HARQ-ACK repetition is enabled or disabled by a UE specific parameter *ackNackRepetition* configured by higher layers. Once enabled, the UE shall repeat any HARQ-ACK transmission with a repetition factor N_{ANRep} , where N_{ANRep} is provided by higher layers and includes the initial HARQ-ACK transmission, until HARQ-ACK repetition is disabled by higher layers. For a PDSCH transmission without a corresponding PDCCH/EPDCCH

Ex. 1007 (36.213), Section 10.1.4, p. 171.

E. Machine Type Communications (“MTC”)

52. MTC involves one or more machines communicating with each other and without human interaction. Ex. 1001, 1:26-30. MTC terminals are often installed in areas where radio wave environments are poor compared to traditional LTE terminals. Ex. 1001 (’931 Patent), 1:33-37.

1. Repetition for Coverage Enhancements

53. An MTC terminal may refer to a terminal that supports coverage enhancement. Ex. 1001 (’931 Patent), 3:56-58. Methods of achieving coverage enhancement were well-known before September 2013. For example, during RAN Meeting#74, ZTE submitted “Discussion on Repetition for Control and Traffic Channel” (Ex. 1008) (“ZTE”), which discusses means of achieving different coverage enhancement targets. ZTE explains that “time domain repetition is the most important coverage enhancement technique for almost all the physical channels. Ex. 1008, Section 1. ZTE specifically applies the technique to PUCCH. Ex. 1008 (ZTE), Section 2.1 (“Repetition of (E)PDCCH/PUCCH across multiple sub-frames may be required to achieve the coverage enhancement target”). For

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example, ZTE teaches that to achieve a coverage enhancement target of 15dB, 10 repetitions of PUCCH are required. Ex. 1008 (ZTE), Table 1.

2. MTC HARQ ACK/NACK Scheduling

54. The '931 Patent acknowledges the issue with scheduling HARQ ACK/NACK signaling for an MTC terminal when control information is repeatedly transmitted from the base station. Ex. 1001, 1:44-61. Namely, the MTC may be uncertain how to determine the resources of an uplink control channel it should use and such resources may conflict with the resources of an uplink control channel of a typical non-MTC (UE) terminal. Ex. 1001 ('931 Patent), 1:44-61, 7:13-16, 7:25-36, and 7:52-62. Such issues, however, were well-known before the priority date of the '931 Patent and solutions were being actively considered.

55. For Example, Yang (U.S. Patent Application Publication No. 2014/0105191; Ex. 1009) discloses an invention that “can be usefully applied to MTC (machine type communication)” EX. 1009 (Yang), ¶67. At the time of its filing, Yang disclosed several possible methods of an MTC scheduling an uplink resource for sending a HARQ ACK/NACK message. For example, Yang proposed having a base station pre-configure four resource sets through higher layer signaling and communicating which resource set a UE should use through 2-bit information. Ex. 1009 (Yang), ¶85. Yang also proposed using the lowest CCE index used for the PDCCH transmission (n_{CCE}) to the MTC and a resource offset ($N^{(1)}_{\text{PUCCH}}$) for the

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MTC to use in order to determine the PUCCH resource it should use for its PUCCH transmission:

$$N^{(1)}_{\text{PUCCH}} = n_{\text{CCE}} + N^{(1)}_{\text{PUCCH}}$$

Ex. 1009 (Yang), ¶89.

56. In considering the issue of multiple UEs transmitting on the same PUCCH, Yang further proposed reserving an ACK/NACK transmission resource for each UE through RRC signaling. Ex. 1009 (Yang), ¶111.

57. Similar disclosures were well established in the 3GPP standard. For example, the 3GPP TS 36.213 specification discloses signaling four PUCCH resource values by higher layer signaling and determining the particular PUCCH resource based on information in a DCI field “TPC command for PUCCH”:

Table 9.2-2: PUCCH resource value for downlink semi-persistent scheduling

Value of 'TPC command for PUCCH'	$n^{(1,p)}_{\text{PUCCH}}$
'00'	The first PUCCH resource value configured by the higher layers
'01'	The second PUCCH resource value configured by the higher layers
'10'	The third PUCCH resource value configured by the higher layers
'11'	The fourth PUCCH resource value configured by the higher layers

Ex. 1007 (36.213), Table 9.2-2, p. 136.

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Resources used for transmission of PUCCH format 1, 1a and 1b are identified by a resource index $n_{\text{PUCCH}}^{(1,\bar{p})}$ from which the orthogonal sequence index $n_{\text{oc}}^{(\bar{p})}(n_s)$ and the cyclic shift $\alpha_{\bar{p}}(n_s, l)$ are determined according to

$$n_{\text{oc}}^{(\bar{p})}(n_s) = \begin{cases} \lfloor n'_{\bar{p}}(n_s) \cdot \Delta_{\text{shift}}^{\text{PUCCH}} / N' \rfloor & \text{for normal cyclic prefix} \\ 2 \cdot \lfloor n'_{\bar{p}}(n_s) \cdot \Delta_{\text{shift}}^{\text{PUCCH}} / N' \rfloor & \text{for extended cyclic prefix} \end{cases}$$

$$\alpha_{\bar{p}}(n_s, l) = 2\pi \cdot n_{\text{cs}}^{(\bar{p})}(n_s, l) / N_{\text{sc}}^{\text{RB}}$$

$$n_{\text{cs}}^{(\bar{p})}(n_s, l) = \begin{cases} \left[\left[n_{\text{cs}}^{\text{cell}}(n_s, l) + \left(n'_{\bar{p}}(n_s) \cdot \Delta_{\text{shift}}^{\text{PUCCH}} + \left(n_{\text{oc}}^{(\bar{p})}(n_s) \bmod \Delta_{\text{shift}}^{\text{PUCCH}} \right) \right) \bmod N' \right] \bmod N_{\text{sc}}^{\text{RB}} \right] & \text{for normal cyclic prefix} \\ \left[\left[n_{\text{cs}}^{\text{cell}}(n_s, l) + \left(n'_{\bar{p}}(n_s) \cdot \Delta_{\text{shift}}^{\text{PUCCH}} + n_{\text{oc}}^{(\bar{p})}(n_s) / 2 \right) \bmod N' \right] \bmod N_{\text{sc}}^{\text{RB}} \right] & \text{for extended cyclic prefix} \end{cases}$$

where

$$N' = \begin{cases} N_{\text{cs}}^{(1)} & \text{if } n_{\text{PUCCH}}^{(1,\bar{p})} < c \cdot N_{\text{cs}}^{(1)} / \Delta_{\text{shift}}^{\text{PUCCH}} \\ N_{\text{sc}}^{\text{RB}} & \text{otherwise} \end{cases}$$

$$c = \begin{cases} 3 & \text{normal cyclic prefix} \\ 2 & \text{extended cyclic prefix} \end{cases}$$

Ex. 1016 (36.211) p. 25.

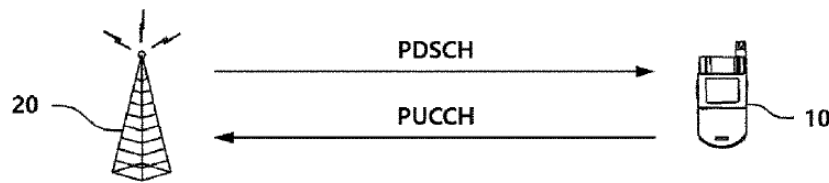
VII. OVERVIEW OF THE '931 Patent

A. Summary of the Disclosure of the '931 Patent

58. The '931 Patent generally is directed to a wireless communication system, and specifically to allocating resources for an uplink control channel for transmitting a Hybrid Automatic Repeat Request (HARQ) acknowledgement (ACK) or negative acknowledgement (NACK). Ex. 1001 ('931 Patent), 1:18-22.

59. In the prior art, HARQ ACK/NACK feedback is transmitted by a terminal on a Physical Uplink Control Channel ("PUCCH") resource in response to a downlink transmission of a Physical Downlink Shared Channel ("PDSCH") by a base station ("BS"). Ex. 1001 ('931 Patent), 6:40-43.

FIG. 1



Ex. 1001 ('931 Patent), FIG. 1.

60. In a typical 3GPP LTE/LTE-Advanced system, the PUCCH resource mapping for the HARQ ACK/NACK is determined according to the following formulas:

$$n_{\text{PUCCH}}^{(1,p0)} = n_{\text{CCE}} + N_{\text{PUCCH}}^{(1)}$$

$$n_{\text{PUCCH}}^{(1,p1)} = n_{\text{CCE}} + N_{\text{PUCCH}}^{(1)}$$

61. The equations calculate the HARQ ACK/NACK feedback resource for an antenna port 0 ($n_{\text{PUCCH}}^{(1,p0)}$) and antenna port 1 ($n_{\text{PUCCH}}^{(1,p1)}$). n_{CCE} denotes the lowest Control Channel Element ("CCE") index in which the corresponding downlink assignment downlink control information ("DCI") is transmitted. $N_{\text{PUCCH}}^{(1)}$ denotes a cell-specific parameter that is configured by higher layer signaling including RRC signaling. Ex. 1001 ('931 Patent), 6:40-62.

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62. The '931 Patent is directed to providing a modified way of determining a PUCCH resource for sending an HARQ ACK/NACK response specifically by a machine type communication ("MTC") terminal. MTC terminals are low capability terminals, which have low performance hardware and software compared to a typical LTE/LTE-Advanced terminal. As a result, a BS will repeatedly transmit PDCCH and PDSCH downlink information to an MTC terminal through a plurality of subframes to improve reception. The repeated transmission across multiple subframes may lead to several possible issues in allocating an uplink resource for HARQ ACK/NACK, including an uncertainty in the CCE index value to be applied to the lowest CCE index by the MTC terminal and the possibility of collisions between a PUCCH resource of the MTC terminal and the PUCCH resource of a separate general LTE terminal. The '931 Patent claims to provide three different embodiments, which "solve" this problem. Ex. 1001 ('931 Patent), 7:13-16, 7:25-36, 7:52-62.

63. In the first embodiment, the prior art PUCCH resource mapping equation is reused with different procedures for determining the PUCCH Resource Offset ($N_{\text{PUCCH},\text{MTC}}^{(1)}$) and the lowest CCE index (n_{CCE}) as defined in the following equations:

$$n_{\text{PUCCH}}^{(1,p0)} = n_{\text{CCE}} + N_{\text{PUCCH},\text{MTC}}^{(1)}$$

$$n_{\text{PUCCH}}^{(1,p1)} = n_{\text{CCE}} + 1 + N_{\text{PUCCH},\text{MTC}}^{(1)}$$

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64. The $N_{\text{PUCCH,MTC}}^{(1)}$ may be configured in a similar manner as a traditional LTE terminal, such as by UE- or cell-specific RRC signaling or by defining a set of start offset parameters and determining the specific parameter using a new or existing DCI field. Alternatively, $N_{\text{PUCCH,MTC}}^{(1)}$ is determined implicitly based on, for example, the number of PDCCH repetitions used for transmitting the corresponding DCI. In a situation where the PDCCH is repeatedly transmitted for better reception, n_{CCE} may be defined in a number of ways, including as the lowest CCE index used for the first PDCCH, the lowest CCE index of the N^{th} PDCCH, or as the smallest CCE index among all the CCE indexes transmitted across the multiple PDCCHs. Ex. 1001 ('931 Patent), 8:6-8; 8:21-9:1-7; 9:24-34.

65. In a second embodiment, a PUCCH resource may be allocated directly with a DCI message sent on the PDCCH to the MTC terminal. In this embodiment, a base station may pre-configure a set of candidate PUCCH resource values and the specific PUCCH resource value is directly indicated to the MTC terminal in the corresponding PDCCH DCI field. Either a new DCI field may be defined for this purpose, or an existing DCI field may be utilized. This process is illustrated in Table 1 of the '931 Patent:

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TABLE 1

PUCCH resource indicator value in downlink allocation DCI	$n_{PUCCH}^{(1,p)}$
'00'	First PUCCH resource value configured by higher layer
'01'	Second PUCCH resource value configured by higher layer
'01'	Third PUCCH resource value configured by higher layer
'11'	Fourth PUCCH resource value configured by higher layer

Ex. 1001 ('931 Patent), TABLE 1.

66. I note that Table 1 shown above from the '931 Patent is practically the same as Table 9.2-2 in the 3GPP TS 36.213 Specification shown below, that existed long before the '931 Patent.

Table 9.2-2: PUCCH resource value for downlink semi-persistent scheduling

Value of 'TPC command for PUCCH'	$n_{PUCCH}^{(1,p)}$
'00'	The first PUCCH resource value configured by the higher layers
'01'	The second PUCCH resource value configured by the higher layers
'10'	The third PUCCH resource value configured by the higher layers
'11'	The fourth PUCCH resource value configured by the higher layers

Ex. 1007 (36.213) Table 9.2-2, p. 136.

67. Each resource candidate may also indicate the number of PUCCH repetitions (i.e., the number of times the HARQ ACK/NACK should be repeatedly transmitted). Ex. 1001 ('931 Patent), 9:48-59; 10:25-31.

68. Finally, the '931 Patent discloses an additional ACK/NACK resource offset value ($\Delta_{ARO, MTC}$) that may be defined through a PDCCH DCI field as shown

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in Table 2. This table is identical to Table 10.1.2.1-1 in 36.213 described in VI.D above, with the exception of the addition of the “MTC” above the right-hand column.

TABLE 2

ACK/NACK resource offset field in DCI format 1A/1B/1D/1/2A/2/2B/2C/2D	$\Delta_{ARO,MTC}$
0	0
1	-1
2	-2
3	2

69. Then the $\Delta_{ARO,MTC}$ value may be applied to the equations defined above to calculate the PUCCH resource:

$$n_{PUCCH}^{(1,p0)} = n_{CCE} + N_{PUCCH,MTC}^{(1)} + \Delta_{ARO,MTC}$$

$$n_{PUCCH}^{(1,p1)} = n_{CCE} + 1 + N_{PUCCH,MTC}^{(1)} + \Delta_{ARO,MTC}$$

Ex. 1001 ('931 Patent), 10:36-45; 10:66-11:7.

70. When compared to the well-established 3GPP specifications, the remaining purportedly “novel” functionality is limited at best. For instance, the 3GPP TS 36.213 specification discloses utilizing a starting offset ($N^{(1)}_{PUCCH}$) that is specified by higher signaling and the number of the first CCE used for transmission of the corresponding PDCCH (n_{CCE}) in order to define a PUCCH channel. Ex. 1007 (36.213), Section 10.1.3.1; VI.D.

71. I understand that the Challenged Claims only require these purported improvements in the alternative and vary only in class (e.g., method/apparatus) and

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frame of reference (e.g., UE/BS). However, as acknowledged by the '931 Patent, the basic equations for allocating PUCCH resources were known and the incremental modifications to these equations disclosed by '931 Patent are broadly claimed such that the claims do not recite anything inventive. As demonstrated below, You in view of Kim and Lee in view of Zhang discloses the same modifications.

B. Challenged Claims

72. I understand that the Petitioners are challenging claims 1-7 (the “Challenged Claims”).

C. Prosecution History

73. The '931 Patent issued from U.S. Patent Application No. 15/025,262 (“262 Application”), which was filed on March 25, 2016, as a National Stage Entry of PCT/KR2014/008765.

74. Before examination, the Applicant cancelled and amended several claims resulting in 16 total claims of which 4 (original claims 1, 7, 13, and 19) were independent. Ex. 1002 ('931 File History), 274-279. The independent claims recite:

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1. (Currently Amended) A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

receiving downlink control information for scheduling the downlink data;

receiving the downlink data; and

transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,

wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; or the start offset information on the resource allocated to the uplink control channel.

7. (Currently Amended) A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in the base station, the method comprising:

transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

transmitting downlink control information for scheduling the downlink data; and

transmitting the downlink data,

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel.

13. (Currently Amended) A terminal for transmitting response information of downlink data to a base station, the terminal comprising:

a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;

a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and

a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel.

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19. (Currently Amended) A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data,

wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start_offset information on the resource allocated to the uplink control channel, and

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start_offset information of the resource allocated to the uplink control channel.

Ex. 1002 ('931 File History), 274-278.

75. During prosecution of the '931 Patent, the claims were repeatedly rejected and amended.

1. First Non-Final Rejection

76. The Examiner rejected independent original Claims 1, 7, 13 and 19 as obvious from U.S. Publication No. 2013/0315159 to Xia et al. ("Xia") in view of U.S. Publication No. 2013/0250882 to Dinan et al. ("Dinan").

77. For example, with regard to Claim 1, The Examiner found that Xia disclosed a method receiving downlink control information for scheduling downlink data and for transmitting response information using a resource allocated to the uplink control channel. Ex. 1002, 286-287. The examiner found Xia did not disclose receiving start offset information on the resource allocated to the uplink channel but that Dinan did. Ex. 1002, 287-288.

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5. **Claims 1, 7, 13 and 19** is/are rejected under 35 U.S.C. 103 as being unpatentable over *Xia*, et al. (US Pre Grant Publication No. 2013/0315159 A1) in view of *Dinan*, et al. (US Pre Grant Publication No. 2013/0250882 A1)

Regarding claim 1, *Xia* discloses a method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

a. Receiving downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the

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appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

b. Receiving the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

c. Transmitting the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose receiving structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses receiving structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. (The system of *Dinan* discloses that the system may have multiple different configured ePDCCH indexes for transmission, with each region associated with an index and each index having a resource offset determining that the starting point of the PDCCH resources to be used [paragraphs 0036-0037].)

Therefore, since the system of *Dinan* suggests the transmission of PDCCH start resource offset information, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* by sending the start resource offset of the PDCCH to the UE. The motive to combine is to improve flexibility

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and decrease complexity by allowing direct signaling of the start resource offset so that it may take any value and does not need to be presumed or calculate based on other factors.

Regarding claim 7, Xia discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in the base station, the method comprising:

- a. Transmitting downlink control information for scheduling the downlink data. (The system of Xia discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)
- b. Transmitting the downlink data (paragraphs 0042, 0048-0049 - see (a), supra).
- c. Receiving the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), supra).

Xia fails to disclose transmitting structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to

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the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses transmitting structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. (The system of *Dinan* discloses that the system may have multiple different configured ePDCCH indexes for transmission, with each region associated with an index and each index having a resource offset determining that the starting point of the PDCCH resources to be used [paragraphs 0036-0037].)

Therefore, since the system of *Dinan* suggests the transmission of PDCCH start resource offset information, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* by sending the start resource offset of the PDCCH to the UE. The motive to combine is to improve flexibility and decrease complexity by allowing direct signaling of the start resource offset so that it may take any value and does not need to be presumed or calculate based on other factors.

Regarding claim 13, *Xia* discloses a terminal for transmitting response information of downlink data to a base station, the terminal comprising:

- a. Receiving unit configured to receive downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base

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station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

b. A receiving unit configured to receive the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

c. A transmitting unit configured to transmit the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose a receiving unit configured to receive structural information that contains start offset information on the resource allocated to the uplink control channel a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses a receiving unit configured to receive structural information that contains start offset information on the resource allocated to the uplink control channel a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on the resource allocated to the uplink control channel. (The system of *Dinan* discloses that the system may have multiple different configured ePDCCH indexes for transmission, with each region associated with an index and each index having a resource offset determining that the starting point of the PDCCH resources to be used [paragraphs 0036-0037].)

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Therefore, since the system of *Dinan* suggests the transmission of PDCCH start resource offset information, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* by sending the start resource offset of the PDCCH to the UE. The motive to combine is to improve flexibility and decrease complexity by allowing direct signaling of the start resource offset so that it may take any value and does not need to be presumed or calculate based on other factors.

Regarding claim 19, *Xia* discloses A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

- a. A transmitting unit configured to transmit downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)
- b. A transmitting unit configured to transmit the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

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c. Receiving the transmitted response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose a transmitting unit configured to transmit structural information that contains start offset information on the resource allocated to the uplink control channel or the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on the start offset information of the resource allocated to the uplink control channel (The system of *Dinan* discloses that the system may have multiple different configured ePDCCH indexes for transmission, with each region associated with an index and each index having a resource offset determining that the starting point of the PDCCH resources to be used [paragraphs 0036-0037].)

Therefore, since the system of *Dinan* suggests the transmission of PDCCH start resource offset information, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* by sending the start resource offset of the PDCCH to the UE. The motive to combine is to improve flexibility and decrease complexity by allowing direct signaling of the start resource offset so that it may take any value and does not need to be presumed or calculate based on other factors.

Ex. 1002, 286-292.

78. The Examiner further rejected original dependent Claims 2, 8, and 14 as obvious from *Xia* in view of *Dinan* and Document No. R1-114268, “Backwards compatible support for reduced bandwidth MTC LTE” submitted to 3GPP TSG RAN WG1 Meeting #67, November 18, 2011 (“R1-114268”); original dependent Claims 3, 4, 9, 10, 15, and 16 as obvious from *Xia* in view of *Dinan*, R1-114268 and U.S. Publication No. 2013/0155974 to Papasalellariou et al. (“Papasalellariou”); and original dependent Claims 6, 12, and 18 as obvious from *Xia* in view of *Dinan* and Document No. R1-131825, “Text Proposal on PUCCH coverage improvement for

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Section 9.5.5 of TR 36.888”submitted to 3GPP TSG RAN WG1 Meeting #72bis, April 19, 2013 (“R1-131825”). Ex. 1002 (’931 File History), 292-299.

2. Amendment after First Non-Final Rejection

79. In response to the Examiner’s rejection, the Applicant canceled three dependent claims and incorporated their limitation into the independent claims to require that start information be determined based on a coverage level:

1. **(Currently Amended)** A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:
 - receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;
 - receiving downlink control information for scheduling the downlink data;
 - receiving the downlink data; and
 - transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; ~~[[or]]~~ and iii) the start offset information on the resource allocated to the uplink control channel; and
wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

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7. **(Currently Amended)** A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in the base station, the method comprising:

transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

transmitting downlink control information for scheduling the downlink data; and
transmitting the downlink data,

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel; and

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

13. **(Currently Amended)** A Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station, the terminal comprising:

a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;

a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and

a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel,

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

19. **(Currently Amended)** A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data,

wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel, ~~and~~

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource

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allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel, and

wherein the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level.

Ex. 1002 ('931 File History), 313-317.

80. The applicant argued the prior art did not disclose transmitting start offset information based on a coverage level.

The cited parts ([0036], [0037]) of *Dinan* merely disclose that uplink control channel parameter may indicate a PUCCH resource starting offset. However, as admitted by the Examiner, *Dinan* does not disclose or teach any descriptions associated with “start offset information (on uplink control channel resources) based on a coverage level.” In particular, *Dinan* does not disclose or teach even the terms “*Machine Type Communication (MTC)*,” “*MTC terminal*,” and “*a coverage level of the MTC terminal*.”

Ex. 1002 ('931 File History)), 319.

Meanwhile, the cited parts ([0124], [0128], FIGs. 15-16) of *Papasakellariou* merely disclose a scheme of increasing a multiplexing capacity of periodic CQI/CSI transmissions from MTC UEs. Specifically, in order to increase a multiplexing capacity of periodic CQI transmissions

for MTC UEs, the periodic CQI is transmitted over only one slot (instead of “over one subframe”) of PUCCH subframe. See paragraphs [0124]-[0127] and FIG. 15 of *Papasakellariou*. In other embodiments of *Papasakellariou*, a periodic CSI is transmitted over only half a resource block (RB) in each of two slots (i.e., “over half a RB in a first slot 1630A and half a RB in a second slot 1630B” instead of “over one RB in a first slot 1610 and one RB in a second slot 1620”). See paragraphs [0128]-[0129] and FIG. 16 of *Papasakellariou*. In summary, the cited parts of *Papasakellariou* merely disclose that periodic CQI/CSI are efficiently transmitted using “less” resources (e.g., only one slot or only half a RB) than a conventional periodic CQI/CSI transmission scheme. In other words, *Papasakellariou* does not disclose or teach any description associated with “start offset” information corresponding to start position information,” even the term “start offset.”

Furthermore, *Papasakellariou* merely discloses “*MTC UEs that are not UL-coverage-limited can be configured to transmit in one slot of a PUCCH subframe.*” See paragraph [0124] (lines 8-10) of *Papasakellariou*. In other words, *Papasakellariou* does not disclose or teach any descriptions associated with “start offset” information (on uplink control channel resources) based on a coverage level.”

Unlike *Dinan* and *Papasakellariou*, in amended claim 1, start offset information on the resource allocated to an uplink control channel is determined based on a coverage level. Therefore, any one of *Dinan* and *Papasakellariou* does not disclose or teach the newly-added limitation “start offset information on uplink control channel resources is determined based on a coverage level” in amended claim 1.

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Ex. 1002 ('931 File History), 319-320.

3. Final Rejection

81. The examiner rejected original independent Claims 1, 7, 13, and 19 again, this time as obvious from Xia in view of Dinan and Papasalellariou.

5. **Claims 1, 7, 13 and 19** is/are rejected under 35 U.S.C. 103 as being unpatentable over *Xia*, et al. (US Pre Grant Publication No. 2013/0315159 A1) in view of *Dinan*, et al. (US Pre Grant Publication No. 2013/0250882 A1) and *Papasalellariou*, et al. (US Pre Grant Publication No. 2013/0155974 A1).

Regarding claim 1, *Xia* discloses a method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

- a. Receiving downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)
- b. Receiving the downlink data (paragraphs 0042, 0048-0049 - see (a), supra).

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c. Transmitting the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose receiving structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses receiving structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. (The system of *Dinan* discloses the use of ePDCCH indexes/sets, which have an associated corresponding uplink control channel parameter [paragraph 0036] which maps to a frequency resource starting offset for the ePDCCH set/index for uplink control channel feedback in the PDCCH [paragraph 0037] and further discloses that the system may utilize different uplink frequency starting offsets in the PUCCH for each of the ePDCCH sets/indexes [paragraph 0131- at least one starting offset indicates more than one may be used]. Putting this together *Dinan* discloses that the system may use multiple ePDCCH indexes/sets, each associated with a particular uplink control channel/PUCCH frequency resource offset)

Therefore, since the system of *Dinan* suggests the transmission of PUCCH feedback start resource offset information associated with a PDCCH group/index, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* sending the starting frequency resource offset of the PUCCH associated with the PDCCH to the UE and using it to determine the starting frequency

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offset of the PUCCH. The motive to combine is to improve flexibility by allowing the starting frequency offset of the PUCCH to vary so that feedback information may be spread across different frequencies.

Xia as modified by *Dinan* and fails to disclose the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. In the same field of endeavor, *Papasalellariou* discloses the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

(*Papasalellariou* discloses that the system may split up the MTC reporting of a terminal based on if the terminals are or are not coverage limited [paragraph 0124] with a coverage limited terminal transmitting in a first slot and frequency offset of the PUCCH [fig. 16, element 1510 and paragraphs 0124 and 0128] and the non-coverage limited MTC terminals transmitting in a second slot and frequency offset [fig. 15, element 1520 – noting that the y axis of fig. 15 is frequency, as it represents the assigned frequency bandwidth and elements 1510 and 1520 are at different positions/offsets in the frequency bandwidth; see also paragraphs 0124 and 0128; see also fig. 16 - showing frequency division in a single slot]).

Therefore, since the system of *Papasalellariou* suggests a different frequency offset for PUCCH feedback for coverage and non-coverage limited MTC devices, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the

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frequency offset of *Papasalellariou* with the system of *Xia* as modified by *Dinan* by using a different ePDCCH indexes/sets with a different uplink control channel/PUCCH frequency resource offsets, as taught by *Dinan* for each of the different uplink PUCCH frequency feedback resources associated with the different coverage levels of *Papasalellariou*. The motive to combine is to separate coverage limited and non-coverage limited UE/terminals, which may require different repetition numbers and rate configurations for transmission, so as to simplify scheduling and allow efficient bandwidth usage.

Regarding claim 7, *Xia* discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in the base station, the method comprising:

- a. Transmitting downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)
- b. Transmitting the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

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c. Receiving the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose transmitting structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses transmitting structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. (The system of *Dinan* discloses the use of ePDCCH indexes/sets, which have an associated corresponding uplink control channel parameter [paragraph 0036] which maps to a frequency resource starting offset for the ePDCCH set/index for uplink control channel feedback in the PDCCH [paragraph 0037] and further discloses that the system may utilize different uplink frequency starting offsets in the PUCCH for each of the ePDCCH sets/indexes [paragraph 0131- at least one starting offset indicates more than one may be used]. Putting this together *Dinan* discloses that the system may use multiple ePDCCH indexes/sets, each associated with a particular uplink control channel/PUCCH frequency resource offset)

Therefore, since the system of *Dinan* suggests the transmission of PUCCH feedback start resource offset information associated with a PDCCH group/index, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* by sending the starting frequency resource offset of the PUCCH associated with the PDCCH to the UE and using it to determine the starting frequency

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offset of the PUCCH. The motive to combine is to improve flexibility by allowing the starting frequency offset of the PUCCH to vary so that feedback information may be spread across different frequencies.

Xia as modified by *Dinan* and fails to disclose the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. In the same field of endeavor, *Papasaellariou* discloses the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

(*Papasaellariou* discloses that the system may split up the MTC reporting of a terminal based on if the terminals are or are not coverage limited [paragraph 0124] with a coverage limited terminal transmitting in a first slot and frequency offset of the PUCCH [fig. 16, element 1510 and paragraphs 0124 and 0128] and the non-coverage limited MTC terminals transmitting in a second slot and frequency offset [fig. 15, element 1520 – noting that the y axis of fig. 15 is frequency, as it represents the assigned frequency bandwidth and elements 1510 and 1520 are at different positions/offsets in the frequency bandwidth; see also paragraphs 0124 and 0128; see also fig. 16 - showing frequency division in a single slot]).

Therefore, since the system of *Papasaellariou* suggests a different frequency offset for PUCCH feedback for coverage and non-coverage limited MTC devices, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the

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frequency offset of *Papasalellariou* with the system of *Xia* as modified by *Dinan* by using a different ePDCCH indexes/sets with a different uplink control channel/PUCCH frequency resource offsets, as taught by *Dinan* for each of the different uplink PUCCH frequency feedback resources associated with the different coverage levels of *Papasalellariou*. The motive to combine is to separate coverage limited and non-coverage limited UE/terminals, which may require different repetition numbers and rate configurations for transmission, so as to simplify scheduling and allow efficient bandwidth usage.

Regarding claim 13, *Xia* discloses a machine type communication MTC terminal for transmitting response information of downlink data to a base station, the terminal comprising:

- a. Receiving unit configured to receive downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)
- b. A receiving unit configured to receive the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

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c. A transmitting unit configured to transmit the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose a receiving unit configured to receive structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses a receiving unit configured to receive structural information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. (The system of *Dinan* discloses the use of ePDCCH indexes/sets, which have an associated corresponding uplink control channel parameter [paragraph 0036] which maps to a frequency resource starting offset for the ePDCCH set/index for uplink control channel feedback in the PDCCH [paragraph 0037] and further discloses that the system may utilize different uplink frequency starting offsets in the PUCCH for each of the ePDCCH sets/indexes [paragraph 0131- at least one starting offset indicates more than one may be used]. Putting this together *Dinan* discloses that the system may use multiple ePDCCH indexes/sets, each associated with a particular uplink control channel/PUCCH frequency resource offset)

Therefore, since the system of *Dinan* suggests the transmission of PUCCH feedback start resource offset information associated with a PDCCH group/index, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offsets of *Dinan* with the system of *Xia* sending the starting frequency resource offset of the

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PUCCH associated with the PDCCH to the UE and using it to determine the starting frequency offset of the PUCCH. The motive to combine is to improve flexibility by allowing the starting frequency offset of the PUCCH to vary so that feedback information may be spread across different frequencies.

Xia as modified by *Dinan* and fails to disclose the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. In the same field of endeavor, *Papasalellariou* discloses the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. (*Papasalellariou* discloses that the system may split up the MTC reporting of a terminal based on if the terminals are or are not coverage limited [paragraph 0124] with a coverage limited terminal transmitting in a first slot and frequency offset of the PUCCH [fig. 16, element 1510 and paragraphs 0124 and 0128] and the non-coverage limited MTC terminals transmitting in a second slot and frequency offset [fig. 15, element 1520 – noting that the y axis of fig. 15 is frequency, as it represents the assigned frequency bandwidth and elements 1510 and 1520 are at different positions/offsets in the frequency bandwidth; see also paragraphs 0124 and 0128; see also fig. 16 - showing frequency division in a single slot]).

Therefore, since the system of *Papasalellariou* suggests a different frequency offset for PUCCH feedback for coverage and non-coverage limited MTC devices, it would have been

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obvious to a person of ordinary skill in the art at the time of the invention to combine the frequency offset of *Papasaellariou* with the system of *Xia* as modified by *Dinan* by using a different ePDCCH indexes/sets with a different uplink control channel/PUCCH frequency resource offsets, as taught by *Dinan* for each of the different uplink PUCCH frequency feedback resources associated with the different coverage levels of *Papasaellariou*. The motive to combine is to separate coverage limited and non-coverage limited UE/terminals, which may require different repetition numbers and rate configurations for transmission, so as to simplify scheduling and allow efficient bandwidth usage.

Regarding claim 19, *Xia* discloses a base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

a. A transmitting unit configured to transmit downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

b. A transmitting unit configured to transmit the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

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c. Receiving the transmitted response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose a transmitting unit configured to transmit information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. In the same field of endeavor, *Dinan* discloses a transmitting unit configured to transmit information that contains start offset information on the resource allocated to the uplink control channel or the resource allocated to the uplink control channel is determined based on the start offset information on the resource allocated to the uplink control channel. (The system of *Dinan* discloses the use of ePDCCH indexes/sets, which have an associated corresponding uplink control channel parameter [paragraph 0036] which maps to a frequency resource starting offset for the ePDCCH set/index for uplink control channel feedback in the PDCCH [paragraph 0037] and further discloses that the system may utilize different uplink frequency starting offsets in the PUCCH for each of the ePDCCH sets/indexes [paragraph 0131- at least one starting offset indicates more than one may be used]. Putting this together *Dinan* discloses that the system may use multiple ePDCCH indexes/sets, each associated with a particular uplink control channel/PUCCH frequency resource offset)

Therefore, since the system of *Dinan* suggests the transmission of PUCCH feedback start resource offset information associated with a PDCCH group/index, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start

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offsets of *Dinan* with the system of *Xia* sending the starting frequency resource offset of the PUCCH associated with the PDCCH to the UE and using it to determine the starting frequency offset of the PUCCH. The motive to combine is to improve flexibility by allowing the starting frequency offset of the PUCCH to vary so that feedback information may be spread across different frequencies.

Xia as modified by *Dinan* and fails to disclose the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. In the same field of endeavor, *Papasalellariou* discloses the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

(*Papasalellariou* discloses that the system may split up the MTC reporting of a terminal based on if the terminals are or are not coverage limited [paragraph 0124] with a coverage limited terminal transmitting in a first slot and frequency offset of the PUCCH [fig. 16, element 1510 and paragraphs 0124 and 0128] and the non-coverage limited MTC terminals transmitting in a second slot and frequency offset [fig. 15, element 1520 – noting that the y axis of fig. 15 is frequency, as it represents the assigned frequency bandwidth and elements 1510 and 1520 are at different positions/offsets in the frequency bandwidth; see also paragraphs 0124 and 0128; see also fig. 16 - showing frequency division in a single slot]).

Therefore, since the system of *Papasalellariou* suggests a different frequency offset for PUCCH feedback for coverage and non-coverage limited MTC devices, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the frequency offset of *Papasalellariou* with the system of *Xia* as modified by *Dinan* by using a different ePDCCH indexes/sets with a different uplink control channel/PUCCH frequency resource offsets, as taught by *Dinan* for each of the different uplink PUCCH frequency feedback resources associated with the different coverage levels of *Papasalellariou*. The motive to combine is to separate coverage limited and non-coverage limited UE/terminals, which may require different repetition numbers and rate configurations for transmission, so as to simplify scheduling and allow efficient bandwidth usage.

Ex. 1002 ('931 File History), 328-340.

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82. While the Examiner acknowledged Xia in view of Dinan failed to disclose MTC devices sending PUCCH feedback at different offsets depending on the applied coverage level, the Examiner found Papasalellariou did. For example, with respect to Claim 1, the Examiner found:

allocated to the uplink control channel is determined based on a coverage level. In the same field of endeavor, *Papasalellariou* discloses the MTC devices send PUCCH feedback at different frequency offsets depending on the applied coverage level, such that the system would need to send separate starting offsets for the different PUCCH channels for the different coverage levels such that the system comprises the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level.

(*Papasalellariou* discloses that the system may split up the MTC reporting of a terminal based on if the terminals are or are not coverage limited [paragraph 0124] with a coverage limited terminal transmitting in a first slot and frequency offset of the PUCCH [fig. 16, element 1510 and paragraphs 0124 and 0128] and the non-coverage limited MTC terminals transmitting in a second slot and frequency offset [fig. 15, element 1520 – noting that the y axis of fig. 15 is frequency, as it represents the assigned frequency bandwidth and elements 1510 and 1520 are at different positions/offsets in the frequency bandwidth; see also paragraphs 0124 and 0128; see also fig. 16 - showing frequency division in a single slot]).

Ex. 1002, 330.

83. The Examiner further rejected original dependent Claims 2, 8, and 14 as obvious from Xia in view of Dinan and R1-14268; dependent Claims 3, 4, 9, 10, 15 and 16 as obvious from Xia in view of Dinan, R1-14268 and Papasalellariou; and

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dependent Claims 6, 12 and 18 as obvious from Xia in view of Dinan and R1-131825.

4. Amendment after Final Rejection

84. In response to the Examiner's rejection, the Applicant cancelled three dependent claims (claims 6, 12 and 18) which required that the response information be repeatedly transmitted and incorporated their limitations into the independent claims:

1. **(Currently Amended)** A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

- receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;
- receiving downlink control information for scheduling the downlink data;
- receiving the downlink data; and
- transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,

wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel; ~~and~~

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

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7. **(Currently Amended)** A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in the base station, the method comprising:

transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

transmitting downlink control information for scheduling the downlink data; and

transmitting the downlink data,

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel; ~~and~~

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

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13. **(Currently Amended)** A Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station, the terminal comprising:

a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;

a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and

a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel,

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

19. **(Currently Amended)** A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data,

wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel,

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a

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downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel, ~~and~~

wherein the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level, and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

Ex. 1002 ('931 File History), 365-369.

85. The Applicant argued R-131825 fails to teach the limitation added to the independent claims from dependent claims 6, 12, and 18, particularly focusing on the limitations' requirement that the resource be transmitted repeatedly in the same uplink subframe:

On page 21 of the FOA, when rejecting claim 6, the Examiner alleged that ***R1-131825*** ("***825***") teaches the limitation of claim 6. However, as to amended claim 1 (including the feature of claim 6), Applicant respectfully disagrees with the Examiner for the reasons set forth below.

The cited part (section 9.5.5.1) of ***825*** merely discloses that a **PUCCH region** is used for a UCI repetitive transmission of an MTC UE. In contrast, in amended claim 1, when response information (e.g., HARQ ACK) of downlink data of an MTC terminal is **repeatedly** transmitted, the repeated transmission is performed using a **same** uplink control channel **resource in each uplink subframe** in which the uplink control channel is repeatedly transmitted.

Therefore, it is believed that ***825*** does **not** disclose or teach the newly-added limitation (i.e., *when the response information of downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink*

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subframe in which the uplink control channel is repeatedly transmitted) in amended claim 1.

Ex. 1002 ('931 File History), 372-373.

5. Second Non-Final Rejection

86. In the last rejection before allowance, the original independent Claims (as well as dependent Claims 2, 8, and 14) were rejected as obvious from Xia in view of “Text proposal on PUCCH coverage improvement for Section 9.5.5 of TR 36.888” presented at the 3GPP Meeting #72bis (“RAN72”) and U.S. Patent Publication No. 2017/0180098 (“You 098”)³.

³ The Petition also cites to references authored by You, U.S. Patent Publication No. 2016/0127952 (“You”) (Ex. 1010) and U.S. Provisional Application No. 61/843,456 (“You ’456”). While the references cited by the Petition share an inventor with You ’098, they are based on an unrelated application.

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5. **Claims 1, 2, 7, 8, 13, 14 and 19** is/are rejected under 35 U.S.C. 103 as being unpatentable over *Xia*, et al. (US Pre Grant Publication No. 2013/0315159 A1) in view of R1-134131 (Author Unknown, Coverage enhancement of DL/UL control channels for low cost MTC, 3GPP TSG-RAN WG1 #74bis, Doc. No. R1-134131, 11 October 2013, pages 1-10) and *You*, et al. (US Pre Grant Publication No. 2017/0180098 A1).

Regarding claim 1, *Xia* discloses a method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

a. Receiving downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

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b. Receiving the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

c. Transmitting the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose receiving structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. In the same field of endeavor, 131 discloses receiving structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. (The system of 131 discloses that the UE receives a coverage/extension/repetition level indication from the base station that indicates start offset of the downlink control channel [page 1, section 2.1, first bullet - "Furthermore, eNB may schedule the transmission of data and control channel according to UE specific coverage extension level...According to this design principle, the starting subframe for (E)PDCCH USS transmission may be configured by higher layer signaling or predefined. For instance, the configuration index consisting of the subframe offset and the periodicity for the potential (E)PDCCH subframes can be signaled, *or the starting offset can be defined as the functions of repetition level.*] Therefore, 131 discloses that the signaled repetition level indicates the start offset and is therefore start offset information that is determined based on the repetition level.)

Therefore, since 131 discloses that the PDCCH downlink offset may be determined based on a coverage/extension/repetition level indication, therefore, it would have been obvious

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to a person of ordinary skill in the art at the time of the invention to combine the repetition based offsets of 131 with the system of *Xia* by using a signaled repetition/coverage level [i.e. start offset information] to determine the start offset of the PDCCH based on repetition/coverage level. The motive to combine is to reduce signaling overhead by using the already indicated repetition level to also indicate the start offset.

Xia as modified by 131 fails to disclose the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the received structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. In the same field of endeavor, *You* discloses the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the received structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level

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[i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. (The system of *You* discloses that the index/offset of the PUCCH used for transmission may be determined based on the CCE of the PDCCH [paragraphs 0272, 0278-0279] [see also 61/949249 - page 0059 (d)].)

Therefore, since *You* suggests using the offset of the PDCCH as the start offset information of the PUCCH used for ACK/NACK transmission, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offset of *You* with the system of *Xia* by using the start offset [i.e. repetition/coverage level information] of the PDCCH to determine both the start offset of the PDCCH and the start offset of the PUCCH that contains the ACK/NACK/response information. The motive to combine is to reduce signaling overhead by using the start offset [i.e. repetition/coverage level information] to determine both PDCCH and PUCCH start offset.

Xia as previously modified by 131 and *You* fails to disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. In the same field of endeavor, another portion of *You* discloses the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. (*You* discloses that the PUCCH resource offset may be held constant throughout the repetition cycle [paragraph 0020] [noting the PUCCH contains the response information/ACK/NACK] [see also 61/949249 - page 0059 last full paragraph].)

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Therefore, since another portion of *You* suggests holding the offset constant when repeating response information in the PUCCH, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the constant offsets of *You* to combine the constant offsets of *You* with the system of *Xia* as previously modified by 131 and *You* by keeping the offset of the PUCCH used for transmitting the response information constant. The motive to combine is to reduce complexity of implementation and overhead by not requiring the determination as to the offset to be re-made for each repetition.

Regarding claims 2, *Xia* as modified by 131 and *You* discloses the start offset information of the resource allocated to the uplink control channel is configured different from start offset information for a terminal different from the MTC terminal. (The system of *Xia* as modified by 131 and *You* disclose that the coverage/reception levels each have different offset information such that terminals at different coverage/reception levels will have different offsets [see the independent claim, *supra*].)

Regarding claim 7, *Xia* discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in the base station, the method comprising:

- a. Transmitting downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent

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at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

b. Transmitting the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

c. Receiving the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose transmitting structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. In the same field of endeavor, 131 discloses transmitting structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. (The system of 131 discloses that the UE receives a coverage/extension/repetition level indication from the base station that indicates start offset of the downlink control channel [page 1, section 2.1, first bullet - "Furthermore, eNB may schedule the transmission of data and control channel according to UE specific coverage extension level...According to this design principle, the starting subframe for (E)PDCCH USS transmission may be configured by higher layer signaling or predefined. For instance, the configuration index consisting of the subframe offset and the periodicity for the potential (E)PDCCH subframes can be signaled, or the starting offset can be defined as the functions of repetition level.] Therefore,

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131 discloses that the signaled repetition level indicates the start offset and is therefore start offset information that is determined based on the repetition level.)

Therefore, since 131 discloses that the PDCCH downlink offset may be determined based on a coverage/extension/repetition level indication, therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the repetition based offsets of 131 with the system of *Xia* by using a signaled repetition/coverage level [i.e. start offset information] to determine the start offset of the PDCCH based on repetition/coverage level. The motive to combine is to reduce signaling overhead by using the already indicated repetition level to also indicate the start offset.

Xia as modified by 131 fails to disclose the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the transmitted structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. In the same field of endeavor, *You* discloses the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the transmitted structural information is start

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offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. (The system of *You* discloses that the index/offset of the PUCCH used for transmission may be determined based on the CCE of the PDCCH [paragraphs 0272, 0278-0279] [see also 61/949249 - page 0059 (d)].)

Therefore, since *You* suggests using the offset of the PDCCH as the start offset information of the PUCCH used for ACK/NACK transmission, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offset of *You* with the system of *Xia* by using the start offset [i.e. repetition/coverage level information] of the PDCCH to determine both the start offset of the PDCCH and the start offset of the PUCCH that contains the ACK/NACK/response information. The motive to combine is to reduce signaling overhead by using the start offset [i.e. repetition/coverage level information] to determine both PDCCH and PUCCH start offset.

Xia as previously modified by 131 and *You* fails to disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. In the same field of endeavor, another portion of *You* discloses the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is

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repeatedly transmitted. (*You* discloses that the PUCCH resource offset may be held constant throughout the repetition cycle [paragraph 0020] [noting the PUCCH contains the response information/ACK/NACK] [see also 61/949249 - page 0059 last full paragraph].)

Therefore, since another portion of *You* suggests holding the offset constant when repeating response information in the PUCCH, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the constant offsets of *to* combine the constant offsets of *You* with the system of *Xia* as previously modified by 131 and *You* by keeping the offset of the PUCCH used for transmitting the response information constant. The motive to combine is to reduce complexity of implementation and overhead by not requiring the determination as to the offset to be re-made for each repetition.

Regarding claim 8, *Xia* as modified by 131 and *You* discloses the start offset information of the resource allocated to the uplink control channel is configured different from start offset information for a terminal different from the MTC terminal. (The system of *Xia* as modified by 131 and *You* disclose that the coverage/reception levels each have different offset information such that terminals at different coverage/reception levels will have different offsets [see the independent claim, *supra*].)

Regarding claim 13, *Xia* discloses a machine type communication MTC terminal for transmitting response information of downlink data to a base station, the terminal comprising:

- a. Receiving unit configured to receive downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042,

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0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

b. A receiving unit configured to receive the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

c. A transmitting unit configured to transmit the response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose a receiving unit configured to receive structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. In the same field of endeavor, 131 discloses a receiving unit [inherent receiver] configured to receive structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. (The system of 131 discloses that the UE receives a coverage/extension/repetition level indication from the base station that indicates start offset of the downlink control channel [page 1, section 2.1, first bullet - "Furthermore, eNB may schedule the transmission of data and control channel according to UE specific coverage extension level...According to this design principle, the starting subframe for (E)PDCCH USS transmission

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may be configured by higher layer signaling or predefined. For instance, the configuration index consisting of the subframe offset and the periodicity for the potential (E)PDCCH subframes can be signaled, *or the starting offset can be defined as the functions of repetition level.*] Therefore, 131 discloses that the signaled repetition level indicates the start offset and is therefore start offset information that is determined based on the repetition level.)

Therefore, since 131 discloses that the PDCCH downlink offset may be determined based on a coverage/extension/repetition level indication, therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the repetition based offsets of 131 with the system of *Xia* by using a signaled repetition/coverage level [i.e. start offset information] to determine the start offset of the PDCCH based on repetition/coverage level. The motive to combine is to reduce signaling overhead by using the already indicated repetition level to also indicate the start offset.

Xia as modified by 131 fails to disclose the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the received structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined by a controller based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. In the same field of endeavor, *You* discloses the start offset of the PDCCH is also used as the start offset of

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the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the received structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined by a controller based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. (The system of *You* discloses that the index/offset of the PUCCH used for transmission may be determined based on the CCE of the PDCCH [paragraphs 0272, 0278-0279] [see also 61/949249 - page 0059 (d)].)

Therefore, since *You* suggests using the offset of the PDCCH as the start offset information of the PUCCH used for ACK/NACK transmission, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offset of *You* with the system of *Xia* by using the start offset [i.e. repetition/coverage level information] of the PDCCH to determine both the start offset of the PDCCH and the start offset of the PUCCH that contains the ACK/NACK/response information. The motive to combine is to reduce signaling overhead by using the start offset [i.e. repetition/coverage level information] to determine both PDCCH and PUCCH start offset.

Xia as previously modified by 131 and *You* fails to disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. In the same field of

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endeavor, another portion of *You* discloses the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. (*You* discloses that the PUCCH resource offset may be held constant throughout the repetition cycle [paragraph 0020] [noting the PUCCH contains the response information/ACK/NACK] [see also 61/949249 - page 0059 last full paragraph].)

Therefore, since another portion of *You* suggests holding the offset constant when repeating response information in the PUCCH, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the constant offsets of to combine the constant offsets of *You* with the system of *Xia* as previously modified by 131 and *You* by keeping the offset of the PUCCH used for transmitting the response information constant. The motive to combine is to reduce complexity of implementation and overhead by not requiring the determination as to the offset to be re-made for each repetition.

Regarding claim 14, *Xia* as modified by 131 and *You* discloses the start offset information of the resource allocated to the uplink control channel is configured different from-start offset information for a terminal different from the MTC terminal. (The system of *Xia* as modified by 131 and *You* disclose that the coverage/reception levels each have different offset information such that terminals at different coverage/reception levels will have different offsets [see the independent claim, *supra*].)

Regarding claim 19, *Xia* discloses a base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

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a. A transmitting unit configured to transmit downlink control information for scheduling the downlink data. (The system of *Xia* discloses that for machine type communication the user endpoint ["UE"] may receive and the base station may send, using the PDCCH [i.e. downlink control channel], a downlink control information ["DCI"] containing scheduling information for downlink transmissions transmitted on the PDSCH [paragraphs 0042, 0048-0049]. The downlink transmissions are received at the UE and sent at the base station at the scheduled time on the PDSCH and the response/ACK [i.e. response information] is sent at the appropriate time on the PUCCH [i.e. uplink control channel] [paragraphs 0043-0044, 0049-0050].)

b. A transmitting unit configured to transmit the downlink data (paragraphs 0042, 0048-0049 - see (a), *supra*).

c. Receiving the transmitted response information on the downlink data by using a resource allocated to the uplink control channel (paragraphs 0043-0044, 0049-0050 - see (a), *supra*).

Xia fails to disclose transmitting structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. In the same field of endeavor, 131 discloses transmitting structural information that contains start offset information on the resource allocated to the *downlink* control channel or the start offset information on the resource allocated to the *downlink* control channel is determined based on a coverage level. (The system of 131 discloses that the UE receives a

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coverage/extension/repetition level indication from the base station that indicates start offset of the downlink control channel [page 1, section 2.1, first bullet - "Furthermore, eNB may schedule the transmission of data and control channel according to UE specific coverage extension level...According to this design principle, the starting subframe for (E)PDCCH USS transmission may be configured by higher layer signaling or predefined. For instance, the configuration index consisting of the subframe offset and the periodicity for the potential (E)PDCCH subframes can be signaled, *or the starting offset can be defined as the functions of repetition level.*] Therefore, 131 discloses that the signaled repetition level indicates the start offset and is therefore start offset information that is determined based on the repetition level.)

Therefore, since 131 discloses that the PDCCH downlink offset may be determined based on a coverage/extension/repetition level indication, therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the repetition based offsets of 131 with the system of *Xia* by using a signaled repetition/coverage level [i.e. start offset information] to determine the start offset of the PDCCH based on repetition/coverage level. The motive to combine is to reduce signaling overhead by using the already indicated repetition level to also indicate the start offset.

Xia as modified by 131 fails to disclose the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the transmitted structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled

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repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. In the same field of endeavor, *You* discloses the start offset of the PDCCH is also used as the start offset of the PUCCH used for ACK/NACK transmission such that the signaled repetition/coverage level [i.e. start offset information] of the PDCCH also signals the start offset information of the response information/ACK/NACK of the PUCCH such that the transmitted structural information is start offset information of the PUCCH and wherein the resource allocated to the uplink control channel is determined based on information on a resource of a downlink control channel for scheduling the downlink data [i.e. the offset of the PDCCH] and the start offset information on the resource allocated to the uplink control channel [i.e. the signaled repetition/coverage level [i.e. start offset information] of the PDCCH, which also signals the offset of the PUCCH] and wherein the start offset information on the resource allocated to the uplink control channel is determined based on the coverage level. (The system of *You* discloses that the index/offset of the PUCCH used for transmission may be determined based on the CCE of the PDCCH [paragraphs 0272, 0278-0279] [see also 61/949249 - page 0059 (d)].)

Therefore, since *You* suggests using the offset of the PDCCH as the start offset information of the PUCCH used for ACK/NACK transmission, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the start offset of *You* with the system of *Xia* by using the start offset [i.e. repetition/coverage level information] of the PDCCH to determine both the start offset of the PDCCH and the start offset of the PUCCH that contains the ACK/NACK/response information. The motive to combine is to reduce signaling overhead by using the start offset [i.e. repetition/coverage level information] to determine both PDCCH and PUCCH start offset.

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Xia as previously modified by 131 and *You* fails to disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. In the same field of endeavor, another portion of *You* discloses the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. (*You* discloses that the PUCCH resource offset may be held constant throughout the repetition cycle [paragraph 0020] [noting the PUCCH contains the response information/ACK/NACK] [see also 61/949249 - page 0059 last full paragraph].)

Therefore, since another portion of *You* suggests holding the offset constant when repeating response information in the PUCCH, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the constant offsets of to combine the constant offsets of *You* with the system of *Xia* as previously modified by 131 and *You* by keeping the offset of the PUCCH used for transmitting the response information constant. The motive to combine is to reduce complexity of implementation and overhead by not requiring the determination as to the offset to be re-made for each repetition.

Ex. 1002 ('931 File History), 382-398.

87. In particular, in Claim 1, for example, the Examiner found the limitation the Applicant added in amendment, to require that the response information be repeatedly transmitted was disclosed by *You*:

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Xia as previously modified by 131 and *You* fails to disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. In the same field of endeavor, another portion of *You* discloses the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. (*You* discloses that the PUCCH resource offset may be held constant throughout the repetition cycle [paragraph 0020] [noting the PUCCH contains the response information/ACK/NACK] [see also 61/949249 - page 0059 last full paragraph].)

Ex. 1002, 385.

88. The Examiner also rejected original dependent Claims as obvious from *Xia* in view of R1-134131, *You* 098 and *Dinan*. U.S. Patent Publication No. 2013/0250882 to *Dinan et al.* (“*Dinan*”).

6. **Claims 3, 4, 9, 10, 15 and 16**, is/are rejected under 35 U.S.C. 103 as being unpatentable over *Xia, et al.* (US Pre Grant Publication No. 2013/0315159 A1), R1-134131 (Author Unknown, Coverage enhancement of DL/UL control channels for low cost MTC, 3GPP TSG-RAN WG1 #74bis, Doc. No. R1-134131, 11 October 2013, pages 1-10) and *You, et al.* (US Pre Grant Publication No. 2017/0180098 A1) as applied to claims 1, 7, 13 and 19 and further in view of *Dinan, et al.* (US Pre Grant Publication No. 2013/0250882 A1).

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Regarding claims 3 and 15, *Xia* fails to disclose each offset information could be associated with a particular coverage/repetition level to form a plurality of pieces of start offset information of the resource allocated to the uplink control channel. In the same field of endeavor, 131 discloses each offset information could be associated with a particular coverage/repetition level to form a plurality of pieces of start offset information of the resource allocated to the uplink control channel (The system of 131 discloses that the UE receives a coverage/extension/repetition level indication from the base station that indicates start offset of the downlink control channel [page 1, section 2.1, first bullet - "Furthermore, eNB may schedule the transmission of data and control channel according to UE specific coverage extension level...According to this design principle, the starting subframe for (E)PDCCH USS transmission may be configured by higher layer signaling or predefined. For instance, the configuration index consisting of the subframe offset and the periodicity for the potential (E)PDCCH subframes can be signaled, *or the starting offset can be defined as the functions of repetition level.*] Therefore, 131 discloses that the signaled repetition level indicates the start offset and is therefore start offset information that is determined based on the repetition level.)

Therefore, since 131 discloses that the PDCCH downlink offset may be determined based on a coverage/extension/repetition level indication, therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the repetition based offsets of 131 with the system of *Xia* by using a signaled repetition/coverage level [i.e. start offset information] to determine the start offset of the PDCCH based on repetition/coverage level. The motive to combine is to reduce signaling overhead by using the already indicated repetition level to also indicate the start offset.

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Xia as modified by 131 and *You* fails to disclose the configuration of the PUCCH offsets using higher layer signaling such that the different offsets of *Xia* as modified by 131 and *You* are configured in the UE such that a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided and the plurality of pieces of start offset information is received through cell-specific high layer signaling for the MTC terminal from a base station. In the same field of endeavor, *Dinan* discloses the configuration of the PUCCH offsets using higher layer signaling such that the different offsets of *Xia* as modified by 131 and *You* are configured in the UE such that a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided and the plurality of pieces of start offset information is received through cell-specific high layer signaling for the MTC terminal from a base station (The system of *Dinan* discloses that the PUCCH configuration [i.e. uplink control channel parameter – see paragraph 0037] may be via RRC signaling [paragraph 0040-“...provided in PUCCH resources identified by the corresponding uplink control channel parameter (in RRC message).”]. *Dinan* further discloses the system may configure multiple PUCCH offsets for different purposes [paragraphs 0036-0037].)

Therefore, since the system of *Dinan* suggests the use of RRC/Higher layer configuration for PUCCH offset/control channel parameter information, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the RRC configuration of *Dinan* with the system of *Xia* as modified by 131 and *You* by using the RRC/higher layer for transmission of offset information for each of the different repetition/coverage level. The motive to combine is to reduce overhead by using RRC to configure the PUCCH control channels, which is a non-periodic transmission and will not need to be resent frequently, unlike other configuration mechanisms, such as the PDCCH.

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Regarding claims 4 and 16, *Xia* as modified by 131, *You* and *Dinan* discloses at least one of the plurality of start offset information is applied according to a corresponding coverage level of the MTC terminal. (see claims 3 and 15, *supra* - the offset frequency information is different for each coverage level and is applied in accordance with the UE/terminal coverage level).

Regarding claim 9, *Xia* fails to disclose each offset information could be associated with a particular coverage/repetition level to form a plurality of pieces of start offset information of the resource allocated to the uplink control channel. In the same field of endeavor, 131 discloses each offset information could be associated with a particular coverage/repetition level to form a plurality of pieces of start offset information of the resource allocated to the uplink control channel (The system of 131 discloses that the UE receives a coverage/extension/repetition level indication from the base station that indicates start offset of the downlink control channel [page 1, section 2.1, first bullet - "Furthermore, eNB may schedule the transmission of data and control channel according to UE specific coverage extension level...According to this design principle, the starting subframe for (E)PDCCH USS transmission may be configured by higher layer signaling or predefined. For instance, the configuration index consisting of the subframe offset and the periodicity for the potential (E)PDCCH subframes can be signaled, *or the starting offset can be defined as the functions of repetition level.*] Therefore, 131 discloses that the signaled repetition level indicates the start offset and is therefore start offset information that is determined based on the repetition level.)

Therefore, since 131 discloses that the PDCCH downlink offset may be determined based on a coverage/extension/repetition level indication, therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the repetition based offsets of 131 with the system of *Xia* by using a signaled repetition/coverage level [i.e. start

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offset information] to determine the start offset of the PDCCH based on repetition/coverage level. The motive to combine is to reduce signaling overhead by using the already indicated repetition level to also indicate the start offset.

Xia as modified by 131 and *You* fails to disclose the configuration of the PUCCH offsets using higher layer signaling such that the different offsets of *Xia* as modified by 131 and *You* are configured in the UE such that a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided and the plurality of pieces of start offset information is transmitted through cell-specific high layer signaling for the MTC terminal from a base station. In the same field of endeavor, *Dinan* discloses the configuration of the PUCCH offsets using higher layer signaling such that the different offsets of *Xia* as modified by 131 and *You* are configured in the UE such that a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided and the plurality of pieces of start offset information is transmitted through cell-specific high layer signaling for the MTC terminal from a base station (The system of *Dinan* discloses that the PUCCH configuration [i.e. uplink control channel parameter – see paragraph 0037] may be via RRC signaling [paragraph 0040-“...provided in PUCCH resources identified by the corresponding uplink control channel parameter (in RRC message).”]. *Dinan* further discloses the system may configure multiple PUCCH offsets for different purposes [paragraphs 0036-0037].)

Therefore, since the system of *Dinan* suggests the use of RRC/Higher layer configuration for PUCCH offset/control channel parameter information, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the RRC configuration of *Dinan* with the system of *Xia* as modified by 131 and *You* by using the RRC/higher layer for transmission of offset information for each of the different repetition/coverage level. The motive to combine is to reduce overhead by using RRC to

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configure the PUCCH control channels, which is a non-periodic transmission and will not need to be resent frequently, unlike other configuration mechanisms, such as the PDCCH.

Regarding claim 10, Xia as modified by 131, You and Dinan discloses at least one of the plurality of start offset information is applied according to a corresponding coverage level of the MTC terminal. (see claim 9, supra - the offset frequency information is different for each coverage level and is applied in accordance with the UE/terminal coverage level).

Ex. 1002 ('931 File History), 398-402.

6. Amendment after Second Non-Final Rejection

89. In response, Applicant amended the original claims to incorporate the limitations of six dependent claims into the four independent claims. While these limitations further limit the “the start offset information,” this is only ***one*** of the ***three alternatives*** recited by the independent claims, as the alternative language recited by the independent claims, i.e., “at least one of,” was never deleted.

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1. **(Currently Amended)** A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

receiving downlink control information for scheduling the downlink data;

receiving the downlink data; and

transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,

wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;

wherein the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal;

wherein a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station;

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

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7. **(Currently Amended)** A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in [[the]] a base station, the method comprising:

transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

transmitting downlink control information for scheduling the downlink data; and

transmitting the downlink data,

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;

wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;

wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;

wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

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13. **(Currently Amended)** A Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station, the terminal comprising:

a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;

a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and

a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel,

wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;

wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from the base station;

wherein the start offset information on the resource allocated to the uplink control channel is

determined based on a coverage level; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

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19. **(Currently Amended)** A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:

a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data,

wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel[[,]]; and

wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel[[,]]; and

wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;

wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;

wherein the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level[[,]]; and

wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

Ex. 100, 425-429.

90. The Applicant argued that R-134131 and You failed to qualify as prior art since their priority date was later than the effective filing date of the '262 Application. Ex. 1002, 430-431.

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91. The Applicant also argued that Xia in view of RAN72, Dinan, and You 098 fails to disclose that the start offset information is configured separated from the start offset information for a terminal different from the MTC terminal. The Applicant further argued that the references fail to disclose a plurality of pieces of start offset information, which are received through cell-specific higher level signaling.

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Meanwhile, although *131* and *You* do not qualify as prior art under §103, independent claim 1 has nevertheless been amended solely for the purpose of expediting prosecution. Specifically, claim 1 has been amended to further include the features of claims 2 and 3 as follows.

Amended independent claim 1 recites in part:

1. A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:
receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;
receiving downlink control information for scheduling the downlink data;
receiving the downlink data; and
transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,
wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;
wherein the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal;
wherein a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station;
wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and
wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

On page 7 of the office action, when rejecting claim 2 (*the start offset information of the resource allocated to the uplink control channel is configured separated from start*

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offset information for a terminal different from the MTC terminal), the Examiner alleges that a combination of *Xia*, *131*, and *You* discloses the feature of claim 2. However, as mentioned above, the references “*131*” and “*You*” do **not** qualify as prior art under §103. Further, in amended claim 1, the start offset information of the resource allocated to the uplink control channel is configured **separated from start offset information for a terminal** (e.g., a non-MTC terminal) **different from the MTC terminal**. Therefore, it is believed that the deficiencies of *Xia* are **not** cured by *131* and *You*. In other words, with respect to amended claim 1 (including the feature of claim 2), it is believed that the 103 rejection is improper.

In addition, on pages 19-21 of the office action, when rejecting **claim 3** (*a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided and the plurality of pieces of start offset information is received through cell-specific high layer signaling for the MTC terminal from a base station*), the Examiner alleges that a combination of *Xia*, *131*, *You*, and *Dinan* discloses the feature of claim 3. However, as mentioned above, the references “*131*” and “*You*” do **not** qualify as prior art under §103. Further, in amended claim 1, **a plurality of pieces of start offset information** of the resource allocated to the uplink control channel are provided. In particular, the plurality of pieces of start offset information are received **through cell-specific high layer signaling for the MTC terminal** from a base station. Therefore, it is believed that the deficiencies of *Xia* are **not** cured by *131*, *You*, and *Dinan*. In other words, with respect to amended claim 1 (including the feature of claim 3), it is believed that the 103 rejection is improper.

Accordingly, it is believed that the Examiner’s assertion about the applied references is improper. In particular, with respect to a “combination” of the applied references, it is believed that the Examiner turned to mere identification in the prior art of each element of the claimed invention. For example, the Examiner turned to individual elements or terms such as “*starting offset*,” “*coverage extension level*,” “*repetition level*,” “*PUCCH resource*” in a plurality of references.

Most inventions arise from a combination of old elements and each element may often be found in the prior art. ... However, **mere identification in the prior art of each element is insufficient to defeat the patentability of the combined subject matter as a whole**. ... Rather, to establish a *prima facie* case of obviousness based on a combination of elements disclosed in the prior art, the

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Board must articulate the basis on which it concludes that it would have been obvious to make the claimed invention. *In re Kahn*, 441 F.3d 977, 986 (Fed. Cir. 2006).

In conclusion, it is believed that amended independent claim 1 is patentable at least for the aforementioned reasons. Withdrawal of this rejection is respectfully requested.

Ex. 1002 ('931 File History), 430-433.

92. A Notice of Allowance was then issued allowing 7 claims including 4 independent claims. The Notice of Allowance provided a Reason for Allowance, which stated simply that the Applicant's arguments were considered and found persuasive. Ex. 1002 ('931 File History), 465-473.

VIII. CLAIM CONSTRUCTION

93. For purposes of this declaration, I assume each claim term is given its plan and ordinary meaning. The prior art would meet each claim limitation under any reasonable construction.

IX. Summary of Grounds for Challenges

94. I understand the Petitioner is challenging the validity of the '931 patent based on two different grounds as summarized below.

Ground	Claims	Basis	Reference(s)
1	1-7	§ 103	You in view of Kim
2	1-7	§ 103	Lee in view of Zhang

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X. Overview of the Prior Art

A. U.S. Patent Publication No. 2016/0127952 (“You”) (Ex. 1010); U.S. Provisional Application No. 61/843,456 (You ’456) (Ex. 1011)⁴

95. U.S. Patent Application No. 14/898,553, published as U.S. Patent Publication No. 2016/0127952 (Ex. 1010) (“You”), is a National Stage Entry under 35 U.S.C. § 371 of International Application No. PCT/KR2014/005100, filed on June 11, 2014, and published as WO/2014/204128 (“You PCT”) (Ex. 1012) on December 24, 2014. The You PCT claims the benefit of U.S. Provisional Application No. 61/843,456 (Ex. 1011, “You ’456”), filed on July 8, 2013, and I understand that both You (Ex. 1010) and You ’456 (Ex. 1011) qualify as prior art under 35 U.S.C. §102(a)(2).

96. You is directed to datalink data transmission techniques for MTC UEs. Ex. 1011, p.14.

⁴ As mentioned above, the examiner cited to another You reference, U.S. Patent Publication No. 2017/0180098 (You 098), during prosecution. While the publication shares an inventor with You and You ’456, it is the publication of an unrelated application.

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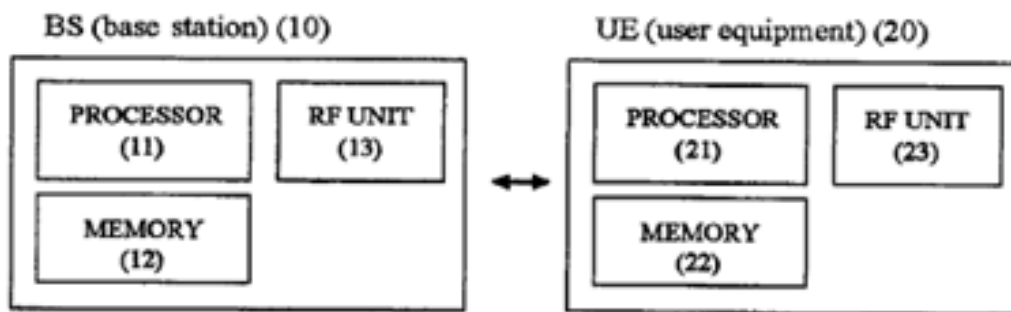


Figure 5. System for implementing present invention

Ex. 1011 (You '456), FIG. 5.

97. Specifically, You discloses techniques for low-cost MTC UEs operating at a reduced bandwidth. You discloses the maximum bandwidth supported by traditional LTE UEs is 20MHz. You also describes that one support option for MTC UEs is reduce the maximum bandwidth to, for example, 1.4MHz, 3MHz, or 5MHz. To support this reduction bandwidth, You discloses adaptations to how downlink and uplink channels are configured and how data is transmitted and received. Ex. 1011 (You '456), pp. 57-58.

98. One such adaptation is to the common search space ("CSS"). To receive downlink data in a PDSCH, a UE must first search for a downlink grant through its CSS region of a PDCCH. You discloses configuring the PDCCH CSS region of an MTC terminal differently from the PDCCH CSS region of a non-MTC terminal. You further discloses configuring the CSS of an MTC terminal for which a coverage enhancement technique is required differently from the CSS of an MTC

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terminal for which a coverage enhancement technique is not required. Ex. 1011 (You '456), p. 62.

99. You also discloses techniques for determining the PUCCH resource for HARQ ACK/NACK transmission. The You non-provisional publication discloses that the uplink control information is transmitted on a PUCCH:

The control region is assigned a PUCCH (physical uplink control channel) for transmission of uplink control information.

Ex. 1010 ¶ 109.

100. The You non-provisional publication further discloses that the uplink control information includes response information (*HARQ (hybrid automatic repeat request), an ACK (acknowledgement)/NACK (non-acknowledgement)*):

The uplink control information transmitted on the PUCCH includes an HARQ (hybrid automatic repeat request), an ACK (acknowledgement)/NACK (non-acknowledgement), a COI (channel quality indicator) indicating a downlink channel state, and an SR (scheduling request) that is an uplink radio resource allocation request.

EX. 1010 ¶ 112.

101. You '456 provides further specifics on how the PUCCH is allocated. Together the You non-provisional publication and You '456 disclose a method for

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determining a PUCCH resource. Specifically, You discloses determining a PUCCH resource for uplink transmission based on the following equation:

$$n_{PUCCH}^{(1,p=p_0)} = (M - m - 1) \cdot N_c + m \cdot N_{c+1} + n_{CCE} + N_{PUCCH}^{(1)}$$

$N_{PUCCH}^{(1)}$ a parameter configured by higher layers and n_{CCE} is the number of the first CCE used for transmission of the corresponding PDCCH. Ex. 1011 (You '456), p. 29.

102. Alternatively, You discloses determining the PUCCH resource by first configuring four possible PUCCH resources through higher level signaling. Then, the particular PUCCH resource to use is signaled in the TPC field in the DCI (Downlink Control Information, Ex. 1011 (You '456), p. 13) format of the corresponding PDCCH. This assignment is illustrated below in Table 19-2:

Table 19-2: PUCCH Resource Value for HARQ-ACK Resource for PUCCH

Value of 'TPC command for PUCCH'	$n_{PUCCH,j}^{(1)}$ or $(n_{PUCCH,j}^{(1)}, n_{PUCCH,j+1}^{(1)})$
'00'	The 1 st PUCCH resource value configured by the higher layers
'01'	The 2 nd PUCCH resource value configured by the higher layers
'10'	The 3 rd PUCCH resource value configured by the higher layers
'11'	The 4 th PUCCH resource value configured by the higher layers

Ex. 1011 (You '456), pp. 57-58; Table 19-2.

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**B. International Publication No. WO/2013/027963 to Kim et al.
("Kim") (Ex. 1013)**

103. International Patent Application No. PCT/KR2012/006493 was filed on August 16, 2012, and published as International Publication No. WO/2013/027963 to Kim et al. (Ex. 1012) ("Kim"). I understand that Kim qualifies as prior art under 35 U.S.C. §102(a)(2).

104. Kim is directed to providing more efficient methods transmitting and receiving an uplink signal. Ex. 1012 (Kim) ¶7.

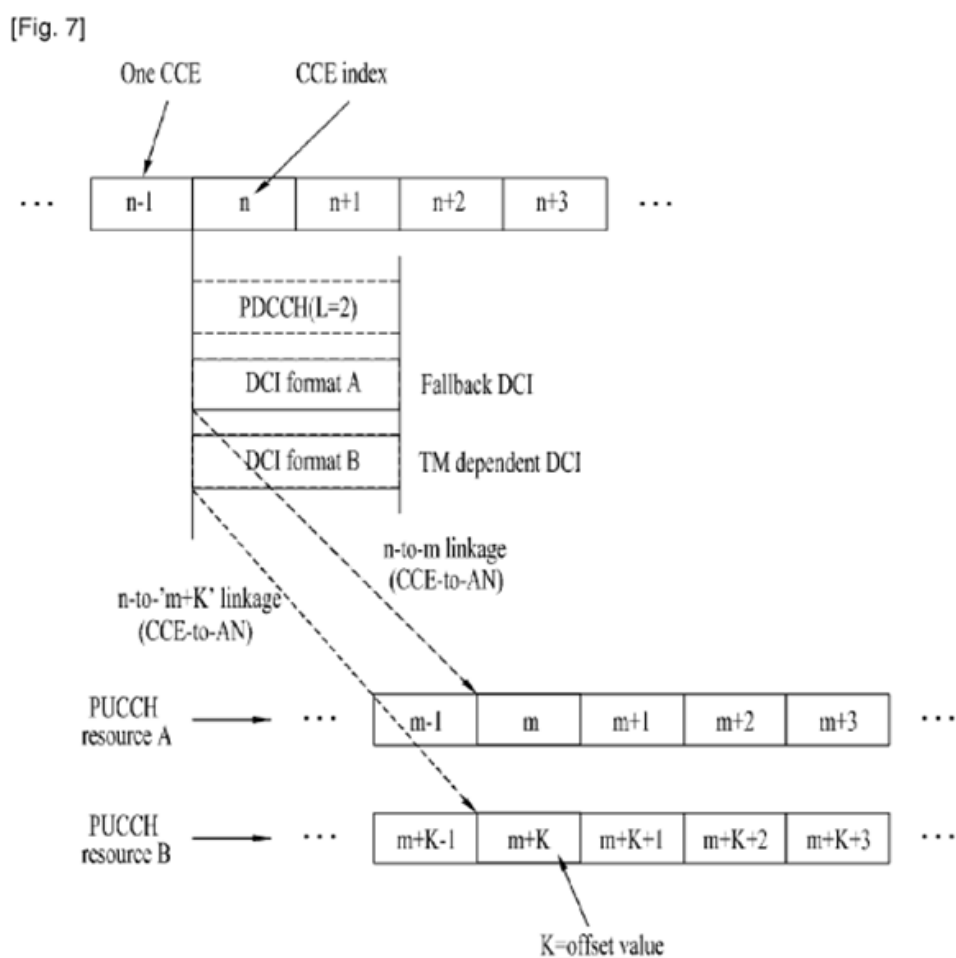
105. Like You, Kim specifically discloses methods of configuring PUCCH resources for uplink HARQ ACK/NACK transmission. Ex. 1012 (Kim) ¶¶7, 10. Specifically, Kim discloses configuring PUCCH resources according to the following equations:

$$n_{PUCCH}^{(1,p=p_0)} = n_{CCE} + N_{PUCCH}^{(1)}$$

106. As with You, this equation is based on the first CCE index used for PDCCH transmission (n_{CCE}) and a configuration parameter signaled by higher layers ($N_{PUCCH}^{(1)}$). Kim discloses that the configuration parameter, $N_{PUCCH}^{(1)}$, corresponds to a location at which a dynamic PUCCH resource is stated among PUCCH resources of a cell, i.e., a resource index offset. Ex. 1012 (Kim) ¶¶112-115, 117.

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107. Kim further discloses additional dynamic PUCCH resources. These resources are configured UE-specifically, UE-group specifically, or TM-specifically and are configured separately from $N_{PUCCH}^{(1)}$, which is provided cell-specifically. Ex. 1012 (Kim) ¶117. For example, in addition to nCCE and $N_{PUCCH}^{(1)}$, Kim discloses transmitting a UE-specific PUCCH offset value, K. Thus, the MTC (M2M terminal) would calculate its PUCCH resource by addition the additional K value. Ex. 1012 (Kim) ¶¶117-120. This is illustrated below in Figure 7.



Ex. 1012 (Kim), FIG. 7.

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C. United States Patent No. 11,470,619 to Lee et al. (“Lee”) (Ex. 1004)

108. United States Patent No. 11,470,619 to Lee et al. (Ex. 1004) (“Lee”) is a National Stage Entry under 35 U.S.C. § 371 of International Application No. PCT/US2014/050211, filed on Feb. 5, 2016, and published as WO/2015/021318 (“Lee PCT”) (EX. 1014) on February 12, 2015. I have been informed by counsel that the Lee PCT claims the benefit of U.S. Provisional Application No. 61/863,328 (Ex. 1005, “Lee ’328”), filed on Aug. 7, 2013, and qualifies as prior art under 35 U.S.C. §102(a)(2).

109. Lee discloses a method of cell selection for a low cost MTC device. Specifically, Lee discloses allowing an MTC device to communicate with a low power node (“LPN”) as opposed to directly with a base station in a traditional macro cell. An MTC may operate in “decoupled” mode where it receives a downlink signal from a base station but will transmit its uplink signal first to an LPN, which will then relay the signal to the base station. Ex. 1005 (Lee ’328) ¶¶28-29; Ex. 1004 (Lee) 10:28-42.

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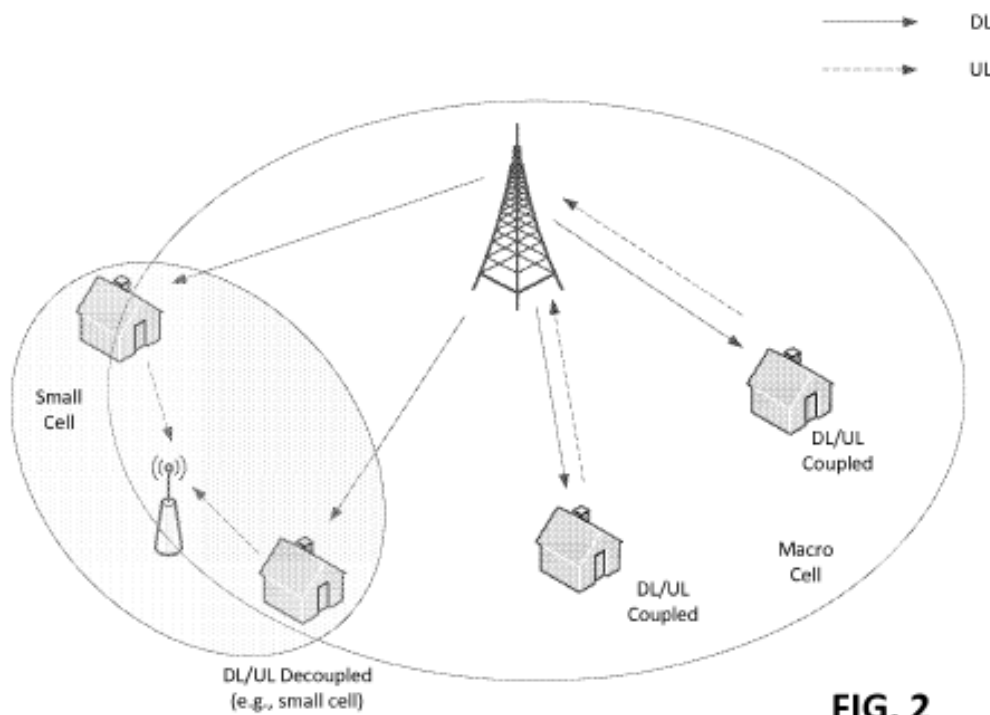


FIG. 2

Ex. 1005 (Lee '328), FIG. 2; Ex. 1004 (Lee), FIG. 2.

110. While transmitting to the LPN, Lee discloses that the MTC may operate in a coverage-limited mode, which may include use of coverage-enhancement transmission schemes such as repetitions. Ex. 1005 (Lee '328) ¶46; Ex. 1004 (Lee), 30:18-26.

111. When operating in this decoupled, coverage-limited mode, Lee teaches that time and frequency synchronization between the LPN and the macro cell is required for uplink transmissions. Lee discloses that this synchronization may be obtained as an offset value from the downlink transmission through higher level signaling. Ex. 1005 (Lee '328) ¶¶80, 82; Ex. 1004 (Lee), 55:8-15, 57:30-32. The required configuration can be provided over a X2 interface. Ex. 1005 (Lee '328)

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¶¶76, 79-80; Ex. 1004 (Lee), 69:50-56. The X2 interface is an LTE standard used for direct communication between base stations. One of the main reasons the X2 interface was added for eNodeBs to directly communicate with each other was to reduce the delay associated with sending signaling messages to/from the core network and the eNodeB for handoffs and other time-critical functions performed by the eNodeBs.

112. Lee also discloses several mechanisms for HARQ feedback from the UE (MTC terminal) when operating in decoupled mode, including ST-based PDSCH HARQ, legacy PUUCH-based HARQ, PUSCH-based HARQ, and modified PDSCH HARQ timing. When using legacy PUCCH-based HARQ operations, Lee discloses the MTC terminal receiving a configuration parameter which may indicate which subframes it may use to send the PDSCH HARQ ACK/NACK via PUCCH. Ex. 1005 (Lee '328) ¶¶83, 91; Ex. 1004 (Lee), 62:17-22, 64:4-14.

D. International Publication No. WO 2014/048487 to Zhang et al. (“Zhang”) (Ex. 1006)

113. International Patent Application No. PCT/EP2012/069193 was filed on September 28, 2012, and published as International Publication No. WO 2014/048487 to Zhang et al. (Ex. 1006) (“Zhang”). I understand that Zhang qualifies as prior art under 35 U.S.C. §102(a)(2).

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114. Zhang generally discloses configuring a PUCCH resource for the UE to transmit a HARQ ACK/NACK to the base station corresponding to a PDSCH scheduled via EPDCCH. Ex. 1006 (Zhang), 4:15-17. Zhang specifically addresses the problem of possible collisions between PUCCH resources resulting from a downlink being transmitted across multiple downlink subframes. To avoid such a collision, Zhang discloses utilizing a dynamic resource offset. Specifically, Zhang discloses utilizing the following formula (discussed in the 3GPP RAN1#70 meeting):

$$n^{(1)}_{\text{PUCCH}} = n_{\text{eCCE}} + N^{(1)}_{\text{UE-PUCCH}} + k$$

Ex. 1006 (Zhang), 4:18-23; 5:1-5; 6:21-25.

115. As similarly disclosed by Lee, $n^{(1)}_{\text{PUCCH}}$ is the PUCCH resource for the HARQ ACK/NACK, n_{eCCE} is the lowest CCE index of the EPDCCH, and $N^{(1)}_{\text{UE-PUCCH}}$ is the UE- and EPDCCH-set-specific resource offset configured by higher level signaling. Additionally, k is the dynamic resource offset. The dynamic offset mechanism is provided to solve the problem of PUCCH resource collision. Ex. 1006 (Zhang), 7:3-5. Zhang discloses that the dynamic offset modifier may be derived independently from the DCI carried by the EPDCCH. Ex. 1006 (Zhang), 6:25-31; 7:28-31.

XI. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-7 are unpatentable over You in view of Kim

1. Reasons to Combine You and Kim

116. You is directed to providing a reduced bandwidth PDSCH, including cell-specific and UE-specific PDSCH, for low-cost MTC UE to provide for coverage enhance of the UE. *See* Ex. 1011 (You '456), pp. 62-63. You expressly states that the content of such cell-specific PDSCH may be different for MTC UEs needing coverage enhancement and those that do not. *See* Ex. 1011 (You '456), p. 62. You's proposed solution is to configure the CCS differently for an MTC UE and a legacy UE, as well as for MTC UEs needing coverage enhance and those that do not. *See* Ex. 1011 (You '456), p. 62. You also provides general background about how PUCCH resources are determined based on the PDDCH for scheduling each PDSCH. For example, You discloses determining a PUCCH resource for uplink transmission based on $N_{PUCCH}^{(1)}$, which is a parameter configured by higher layers, and n_{CCE} , which is the number of the first CCE used for transmission of the corresponding PDCCH. EX-1011 (You '456), pp. 25-29. However, as You does not expressly address changes to the PUCCH, a POSITA would have been motivated to look to other references for ways for increase efficiency of uplink communications, as well as dealing with different types of UEs (e.g., legacy and

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MTC) that receive cell-specific and UE-specific PDSCH, as a POSITA would have understood that the reduced bandwidth capabilities of low-cost MTC UEs would require adaptations to uplink and downlink transmission. Ex. 1011, pg. 58 (“As shown in <Figure 1>, a control channel (i.e., PDDCH) can be transmitted through an entire band region of a carrier bandwidth for a low-cost MTC UE in a downlink environment, whereas a bandwidth of a data channel may be reduced to a smaller value than the system bandwidth. In this case, the following operation may be performed for PDCCH transmission for the low-cost MTC UE.”); Ex. 1010 (You) ¶¶ 161-162.

117. Like You, Kim is assigned to LG Electronics and contemplates configuring resources for MTC UEs. Ex. 1011 (You ’456), p. 58 (“Therefore, the present invention proposes operation techniques *for the low-cost MTC UE* which operates with a reduced bandwidth of a downlink data channel.”); Ex. 1012 (Kim) ¶2 (“*Machine-to-machine (M2M) communication* and a variety of devices such as smartphones and tablet PCs and technology demanding a large amount of data transmission are emerging and becoming widespread.”). Ex. 1011 (You ’456), pg. 58; Ex. 1012 (Kim) ¶ 2. More particularly, Kim is directed to providing a method and apparatus for efficiently transmitting/receiving an uplink signal. Ex. 1012 (Kim) ¶8. Kim’s proposed solution is to configure additional dynamic PUCCH resources by transmitting a UE-specific, UE group-specific, or

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TM-specific resource index offset value K to the UE, separately from a PUCCH resource index offset value cell-specifically based on DCI formats. Ex. 1012 (Kim) ¶¶ 119-120. A POSITA would have understood this to be compatible with You's disclosure of adding specific padding to certain DCI formats to signal specific DL RB assignment to MTC UEs. Further, a POSITA would have had a reasonable expectation of success in doing so given that Kim's disclosure is a straightforward modification of the conventional equations used to determine PUCCH resources that are disclosed in You. Additional motivation for combining You and Kim comes from the fact that they are both assigned to LG Electronics, Inc.

118. It would thus have been obvious for a POSITA to turn to Kim for more information on configuring PUCCH uplink resources.

2. Detailed Application of You and Kim to the Challenged Claims

a. Claim 1

- i. [1.0] A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:*

119. To the extent the preamble is limiting, You discloses⁵ this claim element. Specifically, You discloses "a Machine Type Communication (MTC)

⁵ As used throughout this Declaration, the phrase "discloses" encompasses what a reference would teach, suggest, or render obvious to a POSITA.

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terminal.” Ex. 1011 (You ’456), p. 57. You further discloses transmission of downlink data for an MTC terminal:

In downlink, a transmitter may be a part of the BS 10, and a receiver may be a part of the UE 20.

Ex. 1011 (You ’456), p. 10.

The present invention proposes downlink data transmission techniques for MTC UE with reduced PDSCH transmission BW for lost-cost characteristics.

Ex. 1011 (You ’456), p. 11; Ex. 1010 ¶¶ 173-174.

120. Finally, You discloses transmitting response information (*ACK/NACK/DTX response*) of downlink data (*PDSCH transmission with corresponding PDCCH*):

HARQ-ACK(j), $1 \leq j \leq M-1$, is the ACK/NACK/DTX response for the PDSCH transmission with corresponding PDCCH and DAI value in the PDCCH equal to ' j '.

Ex. 1011 (You ’456), p. 36; Ex. 1010 ¶82.

121. To the extent the preamble is limiting, You discloses limitation [1.0].

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- ii. ***[1.1] receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;***

122. You in combination with Kim discloses this limitation. Specifically, You discloses a UE receiving structural information on a resource allocated to an uplink control channel ($n_{PUCCH}^{(1,p)}$) for transmitting the response information (*HARQ-ACK*):

For TDD HARQ-ACK bundling or TDD HARQ-ACK multiplexing for one configured serving cell and a subframe n with $M = 1$ where M is the number of elements in the set K defined in Table 12, ***the UE shall use PUCCH resource $n^{(1,p)}_{PUCCH}$ for transmission of HARQ-ACK*** in subframe n on antenna port p for PUCCH format 1a/1b.

Ex. 1011 (You '456), p. 28.

123. You further discloses that the resource to an uplink control channel ($n_{PUCCH}^{(1,p)}$) is allocated by a BS (*eNodeB*) according to a specified equation and received by the UE via higher layer signaling:

As illustrated, *eNodeB* 20 may perform functions of selection for gateway 30, routing toward the gateway during a Radio Resource Control (RRC) activation, scheduling and transmitting of paging

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messages, scheduling and transmitting of Broadcast Channel (BCCH) information, dynamic allocation of resources to UEs 10 in both uplink and downlink....

Ex. 1011 (You '456), p. 64.

For a PDSCH transmission or a PDCCH indicating downlink SPS release in subframe $n - k_i$ where $k_i \in K$, the PUCCH resource $n^{(1)}_{\text{PUCCH}i} = (M - i - 1) \cdot N_c + i \cdot N_{c+1} + n_{\text{CCE}i} + N^{(1)}_{\text{PUCCH}}$, where ... $n_{\text{CCE}i}$ is the number of the first CCE used for transmission of the corresponding PDCCH in subframe $n - k_i$ and $N^{(1)}_{\text{PUCCH}}$ ***is configured by higher layers.***

Ex. 1011 (You '456), p. 29.

124. You discloses $N^{(1)}_{\text{PUCCH}}$, but does not elaborate on its precise use. As such, a POSITA would have turned to other references for a further understanding as to the manner in which $N^{(1)}_{\text{PUCCH}}$ is used. Kim discloses equations similar to those disclosed by You to determine the resource allocated to an uplink control channel (*PUCCH resource*):

Specifically, in the 3GPP LTE/LTE-A system, PUCCH resource indexes for transmission by two antenna ports (p_0 and p_1) are determined as follows.

[Equation 5]

$$n^{(1,p=p_0)}_{\text{PUCCH}} = n_{\text{CCE}} + N^{(1)}_{\text{PUCCH}}$$

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[Equation 6]

$$n_{PUCCH}^{(1,p=p_1)} = n_{CCE} + 1 + N_{PUCCH}^{(1)}$$

Ex. 1012 (Kim) ¶¶ 112-114.

125. Kim further discloses that $N_{PUCCH}^{(1)}$ specifies the location after which a UE will acquire its PUCCH resource, i.e. start offset information:

$N_{PUCCH}^{(1)}$ corresponds to a location at which a dynamic PUCCH resource is stated among PUCCH resources of a cell.... In other words, according to a legacy 3GPP LTE/LTE-A system, UEs located in a specific cell *share dynamic PUCCH resources after $N_{PUCCH}^{(1)}$* and the dynamic PUCCH resources are linked to CCE indexes commonly applied to the specific cell, respectively.

Ex. 1012 (Kim) ¶¶ 115-116.

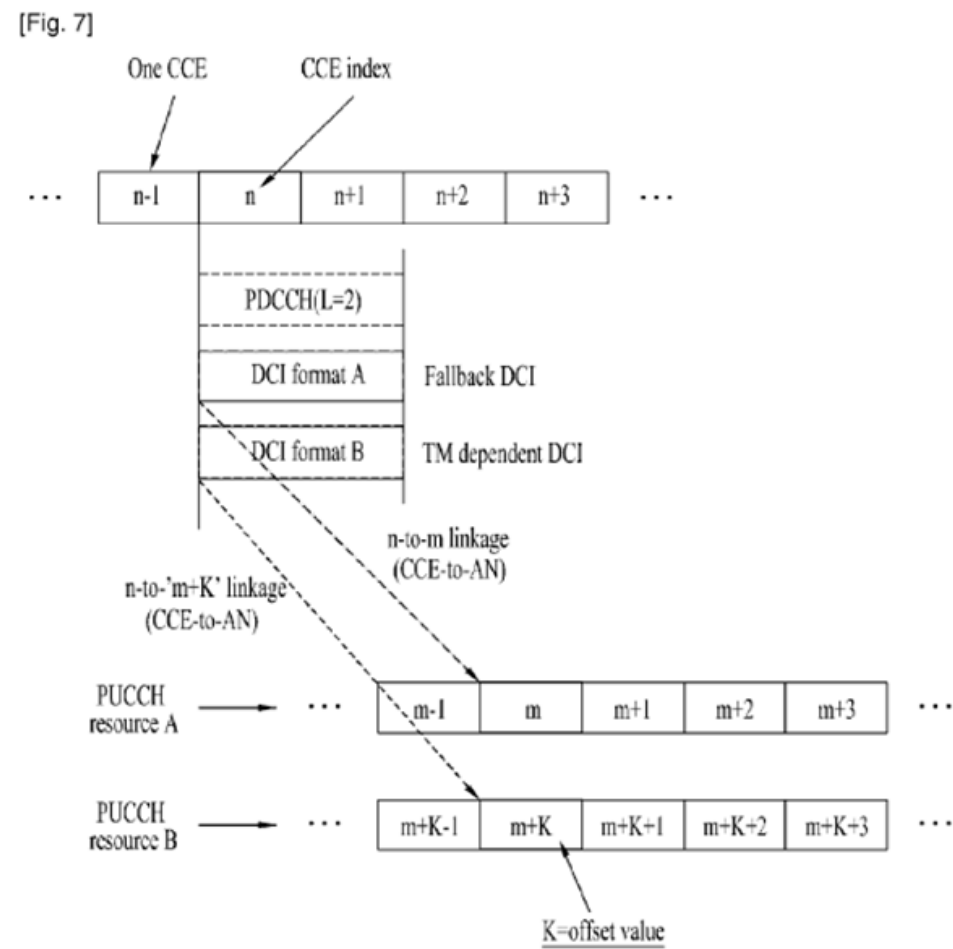
126. In addition to the start offset information, Kim discloses an additional offset value:

In the illustrated example of FIG. 7, a value indicating a relative location based on $N_{PUCCH}^{(1)}$ indicating the start location of the conventional dynamic PUCCH resource among PUCCH resources of a corresponding cell is used as an offset value indicating the start location of the additionally configured dynamic PUCCH resource according to the present invention. However, instead of the relative value based on

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$N^{(1)}_{\text{PUCCH}}$, a value indicating an absolute start location may be used as the offset value indicating the start location of the additionally configured dynamic PUCCH resource according to the present invention.

Ex. 1012 (Kim) ¶ 121.



Ex. 1012 (Kim), FIG. 7.

127. Thus, You in view of Kim renders obvious limitation [1.1].

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***iii. [1.2] receiving downlink control information for
scheduling the downlink data;***

128. You discloses this limitation. You discloses receiving downlink control information (*DCI*) on a downlink control channel (*PDCCH*) for scheduling downlink data on a downlink shared channel (*DL-SCH*):

Examples of downlink control channels used in the 3GPP LTE includes ... ***a physical downlink control channel (PDCCH)***, a physical hybrid ARQ indicator channel (PHICH), etc. The PDCCH may carry a transport format ***and a resource allocation of a downlink shared channel (DL-SCH)*** The BS determines a PDCCH format ***according to a DCI*** to be transmitted to the UE, and attaches a cyclic redundancy check (CRC) to control information.

Ex. 1011 (You '456), p. 13; Ex. 1010 ¶¶ 85-86.

129. Thus, You discloses limitation [1.2].

iv. [1.3] receiving the downlink data; and

130. You discloses this limitation. You explicitly discloses receiving downlink data:

The present invention proposes ***downlink data transmission*** techniques for MTC UE with reduced PDSCH transmission BW for lost-cost characteristics.

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Ex. 1011 (You '456), pp. 11, 57-58; Ex. 1010 ¶¶ 171, 173-175, 179, 196, 205.

131. Accordingly, You discloses limitation [1.3].

- v. ***[1.4] transmitting the response information on the
downlink data by using the resource allocated to
the uplink control channel,***

132. You in combination with Kim discloses this limitation. Both You and Kim disclose transmitting the response information on the downlink data (*HARQ-ACK*) using the resource allocated to the uplink channel (*PUCCH*). Specifically, You discloses:

HARQ-ACK transmission on two antenna ports ($p \in [p0, P1]$) is supported for ***PUCCH format 1a/1b*** with TDD HARQ-ACK bundling feedback mode and for ***PUCCH format 3***.

Ex. 1011 (You '456), p. 28; Ex. 1010 ¶ 112.

133. Kim also discloses transmitting response information (*ACK/NACK*) using a resource allocated to the uplink control channel ($n_{PUCCH}^{(1)}$):

[T]he ACK/NACK information is transmitted using a physical uplink control channel (*PUCCH*) resource determined based on "[Equation 1]
$$n_{PUCCH}^{(1)} = f(n_{CCE}, N_{PUCCH}^{(1)}, X) \dots$$

Ex. 1012 (Kim) ¶ 10.

134. You in combination with Kim thus discloses limitation [1.4].

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- vi. ***[1.5] wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;***

135. You in combination with Kim discloses this limitation. You discloses that the resource allocated to an uplink control channel ($n_{PUCCH}^{(1,p)}$) is determined, in part, based on information on a resource of a downlink control channel (*the number of the first CCE used for transmission of the corresponding PDCCH* (n_{CCEi}) and on a separate configuration parameter ($N_{PUCCH}^{(1)}$):

For a PDSCH transmission or a PDCCH indicating downlink SPS release in subframe $n - k_i$ where $k_i \in K$, the PUCCH resource $n_{PUCCHi}^{(1)} = (M - i - 1) \cdot N_c + i \cdot N_{c+1} + n_{CCEi} + N_{PUCCH}^{(1)}$, where ... ***n_{CCEi} is the number of the first CCE used for transmission of the corresponding PDCCH*** in subframe $n - k_i$ and $N_{PUCCH}^{(1)}$ is configured by higher layers.

Ex. 1011 (You '456), p. 28.

136. Accordingly, You discloses claim element [1.5] as the claim is drafted in the alternative, i.e., “at least one of,” such that only one of the three ways for determining the resource allocated to the uplink control channel, i.e., i), ii), or iii), need be present.

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137. However, as mentioned in XI.A.2.a.ii, Kim further specifies that $N_{PUCCH}^{(1)}$ corresponds to start offset information since UEs search PUCCH resources after $N_{PUCCH}^{(1)}$:

$N_{PUCCH}^{(1)}$ corresponds to a location at which a dynamic PUCCH resource is stated among PUCCH resources of a cell.... In other words, according to a legacy 3GPP LTE/LTE-A system, UEs located in a specific cell *share dynamic PUCCH resources after $N_{PUCCH}^{(1)}$* and the dynamic PUCCH resources are linked to CCE indexes commonly applied to the specific cell, respectively.

Ex. 1012 (Kim) ¶¶ 115-116.

138. Kim further discloses an additional offset, which can be applied to determine the PUCCH resource:

[I]nstead of the relative value based on $N_{PUCCH}^{(1)}$, *a value indicating an absolute start location may be used as the offset value* indicating the start location of the additionally configured dynamic PUCCH resource according to the present invention.

Ex. 1012 (Kim) ¶ 121.

139. You in view of Kim thus discloses determining the resource allocated to the uplink control channel based on 1) information on a resource of a downlink

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control channel for scheduling the downlink data and 2) the start offset information on the resource allocated to the uplink control channel.

140. You further discloses determining this resource based on the information on the resource allocated to the uplink control channel. Specifically, You discloses configuring four PUCCH resources using higher layers and then determining one of these resources using a TPC DCI field in the corresponding PDCCH:

The TPC field in the DCI format of the corresponding PDCCH shall be used to determine the PUCCH resource values from one of the four resource values configured by higher layers, with the mapping defined in Table 19-2.

Ex. 1011 (You '456), p. 47; Ex. 1012 ¶ 129.

Table 19-2: PUCCH Resource Value for HARQ-ACK Resource for PUCCH

Value of 'TPC command for PUCCH'	$n_{\text{PUCCH},j}^{(1)}$ or $(n_{\text{PUCCH},j}^{(1)}, n_{\text{PUCCH},j+1}^{(1)})$
'00'	The 1st PUCCH resource value configured by the higher layers

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‘01’	The 2 nd PUCCH resource value configured by the higher layers
‘10’	The 3 rd PUCCH resource value configured by the higher layers
‘11’	The 4 th PUCCH resource value configured by the higher layers

Ex. 1011 (You ’456), Table 19-2.

141. As described above, such methods were also disclosed in the 3GPP specifications. *See* VI.E.2.

142. Kim similarly discloses configuring possible uplink control channel (*PUCCH*) resources through higher level signaling and determining the specific PUCCH resource using a predetermined DCI field:

For example, the eNB semi-statically ***provides PUCCH resource indexes for the SCC to the UE through higher-layer signaling*** and the UE may dynamically indicate a PUCCH resource index to be used for actual ACK/NACK transmission using a predetermined field in a DCI format. ***For example, a TPC field in the DCI format may be used as an ACK/NACK resource indicator (ARI) indicating one of a predetermined number of explicitly configured PUCCH resources.***

Ex. 1012 (Kim) ¶129.

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143. Thus, You in view of Kim discloses limitation [1.5].

vii. [1.6] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal;

144. You in view of Kim discloses this limitation. You generally discloses the need to develop new operation techniques for MTC UEs:

The maximum bandwidth supported by normal LTE UEs is 20MHz.

One potential technique to reduce the UE cost is to reduce the maximum bandwidth that the UE supports from 20MHz to a lower bandwidth (e.g., 1.4MHz, 3MHz or 5MHz). The reduction of the maximum bandwidth can be applied to the downlink and/or uplink, the RF and/or baseband components, the data and/or control channels.

...

Therefore, the present invention proposes operation techniques for the low-cost MTC UE which operates with a reduced bandwidth of a downlink data channel.

Ex. 1011 (You '456), pp. 57-58.

145. One such different operation technique relates to how UEs receive downlink transmission. You discloses that an MTC UE receives a downlink

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transmission (*cell-specific PDSCH*) by first searching through a common search space region of a PDCCH:

When the MTC UE must receive a cell-specific PDSCH, the UE first searches for a DL grant for receiving a PDSCH through a common search space (CSS) region of a PDCCH.

Ex. 1011 (You '456), p. 62; Ex. 1010 ¶¶ 195-197.

146. You further discloses that the CSS of an MTC UE terminal is configured differently for a terminal different from the MTC terminal (*legacy UE*):

To this end, the present invention proposes to ***differently configure a CSS region of an MTC UE and a CSS region of a legacy UE***. Here, the CSS region may be an RE resource, PRB region, and/or subframe region, or the like of the CSS.

Ex. 1011 (You '456), p. 62.

147. You similarly discloses differently configuring a CSS of MTC with coverage enhancement than one without coverage enhancement:

Furthermore, the present invention proposes to differently configure the CSS region of an MTC UE for which a coverage enhancement technique is required and the CSS region of an MTC UE for which a coverage enhancement technique is not required.

Ex. 1011 (You '456), p. 62; Ex. 1010 ¶ 198.

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148. As mentioned in XI.A.2.a.vi, the resource allocated to the uplink control channel is configured based on, in part, the first CCE used for transmission of the corresponding PDCCH. Ex. 1011 (You '456), p. 28. Thus, a POSITA would have understood, that because the CSS region of the PDCCH for a non-MTC terminal is configured differently than the CSS region of the PDCCH for an MTC terminal, the resource allocated to the uplink control channel of a non-MTC terminal would likewise be configured differently from the resource allocated to the uplink control channel of an MTC terminal.

149. Kim similarly discloses configuring a resource allocated to the uplink control (*PUCCH*) resources differently for different UE terminals (i.e. differently for an MTC terminal and a non-MTC terminal). Specifically, Kim is directed toward a problem of transmission where the downlink cell in which the downlink cell from which a UE receives information may be different from the uplink cell to which a UE sends its response:

However, in CoMP [coordinated multi-point, Kim ¶44] in which a cell (DL cell) in which the UE receives a DL signal may be different from a cell (UL cell) in which the UE transmits a UL signal, PUCCH resources configured per cell may differ.

Ex. 1012 (Kim) ¶ 116.

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150. To solve this problem, Kim discloses configuring dynamic uplink control channel (*PUCCH*) resources which can be UE-specific:

The present invention proposes configuring additional dynamic *PUCCH* resources separately from conventional dynamic *PUCCH* resources. In other words, the present invention proposes *UE-specifically*, UE group-specifically, or TM-specifically ***configuring a set of additional dynamic PUCCH resources separately from a set of cell-specifically configured conventional dynamic PUCCH resources.***

Ex. 1012 (Kim) ¶ 117.

151. Thus, You in view of Kim discloses limitation [1.6].

viii. [1.7] wherein a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station;

152. You in view of Kim discloses this limitation. Both You and Kim disclose receiving the start offset information ($N_{PUCCH}^{(1)}$) through higher level signaling. See Ex. 1011 (You '456), p. 29 (" $N_{PUCCH}^{(1)}$ is configured by higher layers."); Ex. 1012 (Kim) ¶ 115 (" $N^{(1)}_{PUCCH}$ denotes a value signaled from a higher layer.").

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153. Further, Kim discloses that the configuration parameter, which is disclosed in both You and Kim ($N_{PUCCH}^{(1)}$), is cell-specific:

For example, the eNB may configure additional dynamic PUCCH resources by transmitting a UE-specific, UE group-specific, or TM-specific PUCCH resource index offset value K to the UE, separately from a PUCCH resource index offset value (e.g., $N_{PUCCH}^{(1)}$) ***cell-specifically provided for cell 1.***

Ex. 1012 (Kim) ¶ 119. Kim further discloses transmitting a UE-specific additional offset value, K . Ex. 1012 (Kim) ¶ 119. You and Kim thus disclose receiving a plurality of pieces of start offset information through higher-level signaling.

154. Thus, You in view of Kim discloses limitation [1.7].

ix. [1.8] wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

155. You discloses this limitation. As discussed above, You discloses configuring different CSS regions of PDCCH resources, which a POSITA would understand as resulting in allocating different resources to the uplink control channel for non-MTC and MTC terminals because the uplink control channel allocation is based on the PDCCH resources. XI.A.2.a.vii. You further discloses configuring different CCS regions of PDCCH based on a coverage level of an MTC terminal:

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Furthermore, the present invention proposes to differently configure the CSS region of an MTC UE for which a coverage enhancement technique is required and the CSS region of an MTC UE for which a coverage enhancement technique is not required.

Ex. 1011 (You '456), p. 62; Ex. 1010 ¶ 198.

156. Because the resource allocated to the uplink channel is configured based on the configuration of the CSS region of the PDCCH (*see* XI.A.2.a.vii, a POSITA understood that the start offset information is thus applied differently for an MTC terminal with coverage enhancement than an MTC terminal without coverage enhancement. Specifically, You discloses a terminal which determines the start offset of the resource allocated to the uplink channel with both a configuration value ($N_{\text{PUCCH}}^{(1)}$) and the value of the first CCE used for transmission of the corresponding PDCCH (n_{CCE}). Ex. 1011 (You '456), p. 29. Because the n_{CCE} value is based on the PDCCH, it, and therefore the start offset information of the resource allocated to the uplink channel, are determined based on a coverage level.

157. Thus, You discloses limitation [1.8].

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- x. ***[1.9] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.***

158. You discloses this limitation. You discloses utilizing repeated transmissions when in coverage limited mode:

Here, there occurs a problem that a MTC UE requires wider coverage than a legacy UE. Therefore, if eNodeB transmits SIB in the same manner as for a legacy UE, the MTC UE experiences difficulty in receiving the SIB. In order to resolve this problem, when transmitting SIB for the MTC UE having coverage issue through PDSCH, eNodeB may apply coverage enhancement techniques such as subframe repetition, subframe bundling, or the like.

Ex. 1011 (You '456), p. 57.

159. Repeated transmission of a PUCCH resource for HARQ ACK/NACK using a single, identical PUCCH resource in each subframe was well known in the art by September 2013. VI.C. Repeated transmission of PUCCH was also a well understood means of achieving coverage enhancement. VI.E.1. The '931 Patent acknowledges that MTC terminals often operate in areas with relatively poor radio wave environments. Ex. 1001 ('931 Patent), 1:33-37; Ex. 1005 (Lee '328) ¶ 1. A

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POSITA understood the benefits of repeatedly transmitting a HARQ ACK/NACK to ensure reception. Thus, a POSITA would utilize the well-known method of repeatedly transmitting HARQ ACK/NACK through PUCCH over multiple subframes. VI.C. It would further have been obvious to a POSITA to use the same uplink control channel resource in each subframe to avoid recalculating the uplink control channel resource.

160. Therefore, You discloses limitation [1.9]. Thus, for at least the foregoing reasons, You in view of Kim renders obvious claim 1 of the '931 Patent.

b. Claim 2

- b. [2.] The method of claim 1, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.*

161. You in view of Kim renders obvious claim 1 for reasons discussed above in XI.A.2.a. As discussed, because the CSS region of an MTC terminal with coverage enhancement is configured differently than the CSS region of a non-MTC terminal, the start offset information is determined differently according to a coverage level. XI.A.2.a.ix. You thus discloses applying start offset information based on a corresponding coverage level.

162. Accordingly, You in view of Kim renders obvious claim 2 of the '931 Patent.

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c. Claim 3

- i. [3.0] A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station, the method comprising:***

163. To the extent the preamble is limiting, You discloses this claim element.

As shown above in discussing limitation [1.0], You discloses a method of configuring a resource of response information of downlink data for an MTC terminal.

164. You further discloses that the wireless communication system performing the method includes a base station (*BS 10*):

In Figure 5, a wireless communication system ***includes a BS 10*** and one or more UE 20.

Ex. 1011 (You '456), p.14; Ex. 1010 ¶ 49.

165. To the extent the preamble is limiting, You thus discloses limitation [3.0].

- ii. [3.1] transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;***

166. You in combination with Kim discloses this limitation for the same reasons as set forth above in limitation [1.1]. XI.A.2.a.ii. Indeed, limitation 1.1

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requires the reception (and thus corresponding transmission) of structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel.

***iii. [3.2] transmitting downlink control information
for scheduling the downlink data; and***

167. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [1.2]. XI.A.2.a.iii. Indeed limitation 1.2 requires the reception (and thus corresponding transmission) of downlink control information for scheduling the downlink data.

iv. [3.3] transmitting the downlink data,

168. You discloses this limitation for the same reasons as set forth above in limitation [1.3]. XI.A.2.a.iv. Indeed limitation 1.3 requires the reception (and thus corresponding transmission) of downlink data.

***v. [3.4] wherein the resource of the uplink control
channel for transmitting the response information
of the downlink data is determined based on at
least one piece of information on: i) a resource of
a downlink control channel for scheduling the
downlink data; ii) the information on the resource
allocated to the uplink control channel; and iii) the
start offset information on the resource allocated
to the uplink control channel;***

169. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [1.5]. XI.A.2.a.vi. Indeed, limitation 1.5 requires the

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resource of the uplink control channel to be determined based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel.

- vi. [3.5] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;***

170. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [1.6]. XI.A.2.a.vii. Indeed limitation 1.6 requires the start information of the resource allocated to the uplink channel be configured separated from offset information on a terminal different from the MTC terminal.

- vii. [3.6] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;***

171. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [1.7]. XI.A.2.a.viii. Indeed limitation 1.7 requires a plurality of pieces of start offset information on the resource allocated to the uplink control channel be provided and received (and correspondingly transmitted) through

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cell-specific high layer signaling for the MTC terminal from the base station (and correspondingly to the MTC terminal).

viii. [3.7] wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

172. You discloses this limitation for the same reasons as set forth above in limitation [1.8]. XI.A.2.a.ix. Indeed limitation 1.8 requires the start offset information on the resource allocated to the uplink control channel be determined based on a coverage level.

ix. [3.8] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

173. You discloses this limitation for the same reasons as set forth above in limitation [1.9]. XI.A.2.a.x. Indeed limitation 1.9 requires the response information of the downlink data of the MTC terminal be repeatedly transmitted and the repeated transmission be performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

174. Therefore, for at least the foregoing reasons, You in view of Kim renders obvious claim 3 of the '931 Patent.

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d. Claim 4

- i. [4.] The method of claim 3, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.*

175. You in view of Kim renders obvious claim 3 for reasons discussed above in XI.A.2.c. You further discloses this claim for the same reasons as set forth above with respect to claim 2. XI.A.2.b. Indeed claim 2 requires at least one of the plurality of pieces of start offset information be applied according to a corresponding coverage level of the MTC terminal.

176. Accordingly, You in view of Kim renders obvious claim 4 of the '931 Patent.

e. Claim 5

- i. [5.0] A Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station, the terminal comprising:*

177. To the extent the preamble is limiting, You discloses this claim element.

178. As discussed above in [1.0], You discloses a Machine Type Communication (MTC) terminal configured to receive downlink data and transmit response information. XI.A.2.a.i. Further, you discloses a base station which can receive an uplink signal:

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In Figure 5, a wireless communication system includes a BS 10 and one or more UE 20. ... In uplink, a transmitter may be a part of the UE 20, and ***a receiver may be a part of the BS 10.***

Ex. 1011 (You '456), p. 14; Ex. 1010 ¶ 51.

179. To the extent the preamble is limiting, You thus discloses limitation [5.0].

- ii. ***[5.1] a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;***

180. You in view of Kim discloses this limitation.

181. You discloses a receiving unit (receiver):

In Figure 5, a wireless communication system includes a BS 10 and one or more UE 20. ... In uplink, a transmitter may be a part of the UE 20, and ***a receiver may be a part of the BS 10.***

Ex. 1011 (You '456), p. 14; Ex. 1010 ¶ 51.

182. You in view of Kim discloses the remainder of the limitation for the same reasons as set forth above in limitations [1.1]-[1.3]. XI.A.2.a.ii-XI.A.2.a.iv.

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Indeed limitation 1.1 requires receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. Limitation 1.2 requires receiving downlink control information for scheduling the downlink data. And limitation 1.3 requires receiving downlink data.

iii. [5.2] a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and;

183. You in view of Kim discloses this limitation. Specifically, You discloses a controller (processor 11):

A BS 10 may include a processor 11, a memory 12, and a radio frequency (RF) unit 13. The processor 11 may be configured to implement proposed procedures and/or methods described in this application.

...

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A UE 20 may include *a processor 21*, a memory 22, and a RF unit 23.

The processor 21 may be configured to implement proposed procedures and/or methods described in this application.

Ex. 1011 (You '456), p. 14; Ex. 1010 ¶¶ 236-237.

184. You in view of Kim discloses the remainder of this limitation for the same reasons as set forth above in limitation [1.5]. XI.A.2.a.vi. Indeed limitation 1.5 requires the resource allocated to the uplink control channel be determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel

iv. [5.3] a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel,

185. You discloses this limitation. You discloses a transmitting unit (transmitter) as a part of the UE transmitting the response information:

In Figure 5, a wireless communication system includes a BS 10 and one or more UE 20. I... In uplink, *a transmitter may be a part of the UE 20*, and a receiver may be a part of the BS 10.

Ex. 1011 (You '456), p. 14; Ex. 1010 ¶ 51.

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186. You in view of Kim discloses the remainder of this limitation for the same reasons as set forth above in limitation [1.4]. XI.A.2.a.v. Indeed limitation 1.4 requires transmitting the response information on the downlink data by using the resource allocated to the uplink control channel.

- v. [5.4] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;***

187. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [1.6]. XI.A.2.a.vii. Indeed limitation 1.6 requires the start offset information of the resource allocated to the control channel be configured separated from offset information on a terminal different from the MTC terminal.

- vi. [5.5] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from the base station;***

188. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [1.7]. XI.A.2.a.viii. Indeed limitation 1.7 requires a plurality of pieces of start offset information on the resource allocated to the uplink control channel be provided, and requires the plurality of pieces of start offset information be received through cell-specific high layer signaling for the MTC terminal from the base station.

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- vii. [5.6] wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and***

189. You discloses this limitation for the same reasons as set forth above in limitation [1.8]. XI.A.2.a.ix. Indeed limitation 1.8 requires the start offset information on the resource allocated to the uplink control channel be determined based on a coverage level.

- viii. [5.7] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.***

190. You discloses this limitation for the same reasons as set forth above in limitation [1.9]. XI.A.2.a.x. Indeed limitation 1.9 requires the response information of the downlink data of the MTC terminal be repeatedly transmitted, the repeated transmission being performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

191. Therefore, You in view of Kim renders obvious claim 5 of the '931 Patent.

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f. Claim 6

- i. [6.] The MTC terminal of claim 5, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.***

192. You in view of Kim renders obvious claim 5 for reasons discussed above in XI.A.2.e.

193. You discloses this claim for the same reasons as set forth above with respect to claim 2. XI.A.2.b. Indeed claim 2 requires at least one of the plurality of pieces of start offset information be applied according to a corresponding coverage level of the MTC terminal.

194. Accordingly, You in view of Kim renders obvious claim 6 of the '931 Patent.

g. Claim 7

- i. [7.0] A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:***

195. To the extent the preamble is limiting, You discloses this limitation.

196. As shown above in discussing limitation [1.0], You discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. XI.A.2.a.i. You also discloses a base station (BS 10):

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In Figure 5, a wireless communication system includes *a BS 10* and one or more UE 20. In downlink, a transmitter may be a part of the BS 10, and a receiver may be a part of the UE 20.

Ex. 1011 (You '456), p. 14; Ex. 1010 ¶ 51.

197. You further discloses that the base station includes a processor capable of configuring a resource for response information:

A BS 10 may include a processor 11, a memory 12, and a radio frequency (RF) unit 13. The processor 11 may be configured to implement proposed procedures and/or methods described in this application.

Ex. 1011 (You '456), p. 14; Ex. 1010 ¶ 51.

198. To the extent the preamble is limiting, You thus discloses limitation [7.0].

ii. [7.1] transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data;

199. You in view of Kim discloses this limitation. You discloses that the base station includes a transmitting unit:

In uplink, *a transmitter may be a part of the UE 20*, and a receiver may be a part of the BS 10.

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Ex. 1011 (You '456), p. 14; Ex. 1010 ¶ 51.

200. Further as discussed above in connection with limitations [3.1]-[3.3], You in view of Kim discloses the transmission of structural information, downlink control information for scheduling the downlink data, and the downlink data.

XI.A.2.c.ii-XI.A.2.c.iv.

iii. [7.2] wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;

201. You in view of Kim discloses this limitation for the same reasons as set forth above in limitations [5.1]. XI.A.2.e.ii. Indeed limitation 5.1 requires the structural information contain at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data.

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- iv. [7.3] wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel;***

202. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [3.4]. XI.A.2.c.v. Indeed, limitation 3.4 requires the resource of the uplink control channel for transmitting the response information of the downlink data be determined based on at least one piece of information on: i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel.

- v. [7.4] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;***

203. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [3.5]. XI.A.2.c.vi. Indeed limitation 3.5 requires the start offset information of the resource allocated to the uplink control channel be configured separated from offset information on a terminal different from the MTC terminal.

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- vi. [7.5] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;***

204. You in view of Kim discloses this limitation for the same reasons as set forth above in limitation [3.6]. XI.A.2.c.vii. Indeed limitation 3.6 requires a plurality of pieces of start offset information on the resource allocated to the uplink control channel be provided, and requires the plurality of pieces of start offset information be transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal.

- vii. [7.6] wherein the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level; and***

205. You discloses this limitation for the same reasons as set forth above in limitation [3.7]. XI.A.2.c.viii. Indeed limitation 3.7 requires the start offset information on the resource allocated to the uplink control channel be determined based on a coverage level.

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viii. [7.7] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

206. You discloses this limitation for the same reasons as set forth above in limitation [3.8]. XI.A.2.c.ix. Indeed limitation 3.8 requires the response information of the downlink data of the MTC terminal be repeatedly transmitted, and requires the repeated transmission be performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

207. Therefore, for at least the foregoing reasons, You in view of Kim renders obvious claim 7 of the '931 Patent.

B. Ground 2: Claims 1-7 are unpatentable over Lee in view of Zhang

1. Reasons to Combine Lee and Zhang

208. Lee is directed to providing coverage enhancements for low-cost machine-type communication (LC-MTC) devices on at least an LTE 4G network Ex. 1005 (Lee '328) ¶ 1, which enable machines to communicate without human intervention. Ex. 1005 (Lee '328) ¶ 1; Ex. 1004 (Lee), 1:19-21. In addition to cell selection for LC-MTC devices, Lee discloses that one or more mechanisms may be used for HARQ communications, including SR-based PDSCH HARQ, legacy PUCCH-based HARQ, PUSCH-based HARQ, and modified PDSCH HARQ.

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Ex. 1005 (Lee '328) ¶83; Ex. 1004 (Lee), 62:17-22. As such, a POSITA would have understood Lee as not being specific as to which methodology to use and thus been motivated to look to other references to determine a suitable methodology for implementing HARQ feedback, including for PUCCH-based HARQ feedback for MTC devices, so as to avoid collisions.

209. Zhang is directed to PUCCH format 1a/1b resource allocation for HARQ-ACKs based on discussions during the 3GPP RAN1#70 meeting. Ex. 1006 (Zhang), 1:33-2:5, 10:11-31. More particularly, Zhang addresses the problem of possible collisions between PUCCH resources resulting from downlink subframes. Zhang discloses methods for PUCCH resource allocation designed advantageously to avoid PUCCH resource collisions between EPDCCH and PDCCH, which resources are both contemplated and discussed in Lee, by using a dynamic resource offset using the following formula discussed during the 3GPP RAN1#70 meeting.

$$n_{PUCCH}^{(1)} = n_{eCCE} + N_{UE-PUCCH}^{(1)} + k$$

Ex. 1006 (Zhang), 3:33-4:2, 4:18-23, 5:1-5, 6:21-25; Ex. 1005 (Lee '328) ¶¶ 51-60. Zhang further discloses that an eNB allocates the PUCCH resources via signaling and then receives HARQ feedback from the UE on the allocated resource. Ex. 1006 (Zhang), 14:8-17 (“Before transmitting the signaling in item 802, eNB 401 may receive the HARQ-ACK signaling transmitted from the UE 401 by utilizing the configured PUCCH format 1 a/b resource for EPDCCH signaling in TDD.”).

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210. Zhang explicitly discloses that its invention is applicable to any user terminal or communication system, which supports PUCCH resource allocation for HARQ-ACK corresponding to PDSCH scheduled via EPDCCH. Ex. 1006 (Zhang), 9:35-10:2. Lee discloses exactly such a user terminal and communication system, and thus it would be obvious to a POSITA to use the PUCCH resource allocation method disclosed by Zhang in the MTC communication system disclosed by Lee. A POSITA would have had a reasonable expectation of success in combining the teachings of Lee with those of Zhang given that Zhang was using known techniques (e.g., those agreed to during RAN1#70 meeting) in a known way to yield a predictable result (e.g., PUCCH resource allocation). Ex. 1006 (Zhang) 6:21-35.

2. Detailed Application of Lee and Zhang to the Challenged Claims

a. Claim 1

i. [1.0] A method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal, the method comprising:

211. To the extent the preamble is limiting, Lee discloses this limitation. Specifically, Lee discloses “[s]ystems, methods, and instrumentalities are disclosed to describe cell selection in low cost machine type communication (LC-MTC) devices.” Ex. 1005 (Lee ’328) ¶2; Ex. 1004 (Lee), 1:35-37. Lee further discloses

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an MTC terminal (*LC-MTC device*) receiving downlink data (*downlink; data received via PDSCH*):

As illustrated in FIG. 2, in DL/UL coupled case, an LC-MTC device may communicate with a Macro cell for uplink and/or downlink. In DL/UL decoupled case, ***an LC-MTC may communicate with Macro cell for downlink*** while transmitting uplink signal to low power node (LPN).

Ex. 1005 (Lee '328) ¶ 28; Ex. 1004 (Lee), 10:28-33.

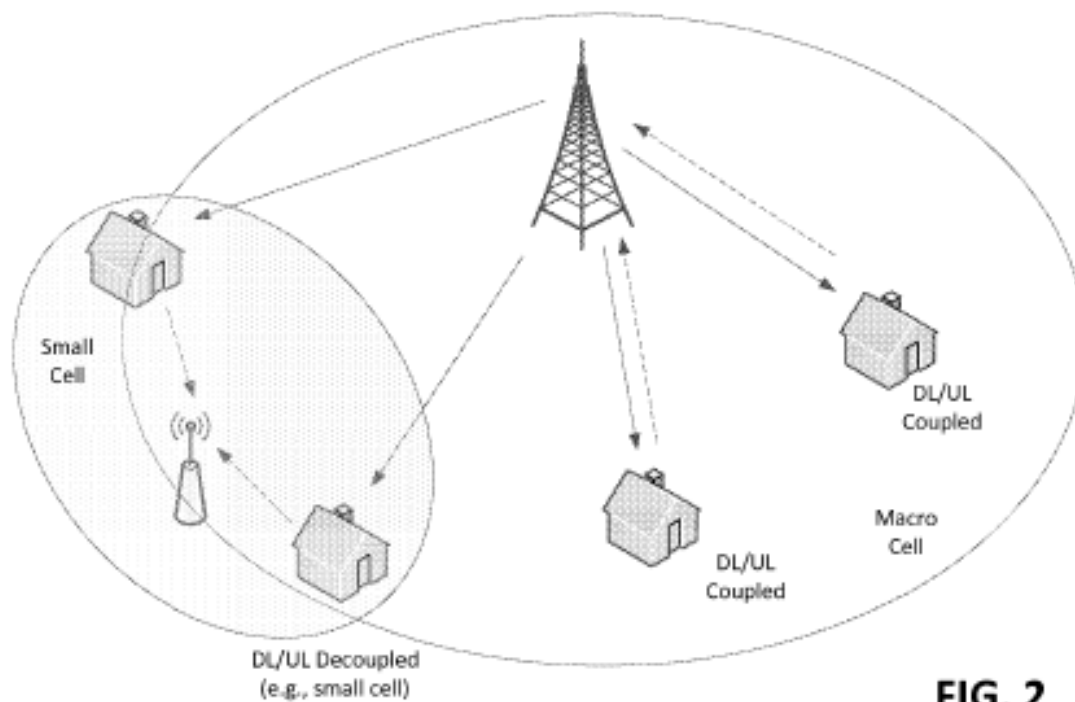


FIG. 2

Ex. 1005 (Lee '328), FIG. 2; Ex. 1004 (Lee), FIG. 2.

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212. Finally, Lee discloses sending response information of downlink data (*HARQ feedback*) to the LPN, which is ultimately forwarded to the Macro/eNB:⁶

In decoupled operation arrangement (e.g., assuming DL transmissions from the Macro and UL transmissions to the LPN), upon the reception of the Physical Downlink Shared Channel (PDSCH) by the UE, the UE may send the corresponding Hybrid Automatic request (HARQ) feedback to the LPN. The LPN may communicate the feedback to the serving eNB, which may have sent the corresponding PDSCH.

Ex. 1005 (Lee '328) ¶ 38; Ex. 1004 (Lee), 61:35-42.

213. To the extent the preamble is limiting, Lee thus discloses limitation [1.0].

- ii. ***[1.1] receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;***

214. Lee in combination with Zhang discloses this limitation. For example, Lee discloses receiving structural information, including information on a resource

⁶ Lee states that UE and LC-MTC are used interchangeably. EX. 1005 (Lee '328) ¶ 32 (“The low cost MTC (LC-MTC) device, low-cost UE, UE, LC-MTC UE, MTC UE, and/or LC-UE, WTRU may be used herein interchangeably to refer to an MTC device that may be low cost.”); Ex. 1004 (Lee), 16:15-21.

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allocated to an uplink control channel for transmitting the response (*configuration parameter*):

Legacy PUCCH-based HARQ ACK/NACK may be provided. The UE may not send PDSCH HARQ ACK/NACK bits (e.g., via PUCCH) in each UL subframe. The UE may receive ***a configuration parameter indicating the subframes the UE may use to send PDSCH HARQ ACK/NACK bits (e.g., via PUCCH).*** The UE may receive a configuration parameter, e.g., a parameter *r* which may indicate that ***each *r*-th subframe may include PUCCH resources allocated to the UE and/or the UE may transmit PDSCH HARQ ACK/NACK bits (e.g., via PUCCH) in those subframes.***

Ex. 1005 (Lee '328), ¶ 91; Ex. 1004 (Lee), 64:5-14.

215. Because Lee does not explicitly disclose how the configuration parameter is applied to allocate an uplink resource, a POSITA would have been motivated to turn to other references, such as Zhang, for a more expansive explanation of legacy-PUCCH. XI.B.1.

216. Zhang discloses a PUCCH resource allocation method to address the issues discussed during the RAN1#70 meeting. Ex. 1006 (Zhang), 3:15-31. Specifically, Zhang discloses:

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In the case of FDD, the PUCCH format 1a/1b HARQ-ACK resource in response to EPDCCH scheduled PDSCH may be described with the following formula (RAN1#70 agreement):

$$n^{(1)}_{\text{PUCCH}} = n_{\text{eCCE}} + N^{(1)}_{\text{UE-PUCCH}} + k$$

Ex. 1006 (Zhang), 6:21-25.

217. Zhang further discloses that, in addition to the configuration parameter ($N^{(1)}_{\text{UE-PUCCH}}$), the formula includes a dynamic offset modifier (*start offset information*):

$n^{(1)}_{\text{PUCCH}}$ is the PUCCH format 1 a/b resource for the HARQ-ACK, n_{eCCE} is the index of the lowest eCCE of the detected EPDCCH carrying the DL assignment, $N^{(1)}_{\text{UE-PUCCH}}$ is UE- and EPDCCH-set-specific PUCCH resources offset configured by higher layers (via a protocol layer higher than the physical layer), and k is *a dynamic offset modifier such as an antenna port-specific offset associated with antenna port p , where p is the antenna port allocated to the first CCE of corresponding EPDCCH or other explicitly signaled or implicitly derived parameter.*

Ex. 1006 (Zhang), 6:27-35.

218. Lee in view of Zhang renders obvious limitation [1.1].

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***iii. [1.2] receiving downlink control information for
scheduling the downlink data;***

219. Lee in combination with Zhang discloses this limitation. Lee discloses receiving downlink control information (*data on a downlink control channel (EPDCCH)*):

The coupled mode may support data and ***control channel*** while decoupled mode may support data channel, where the data and ***control channels*** may include but not limited to PDSCH, PUSCH, PHICH, ***(E)PDCCH [Enhanced Physical Downlink Control Channel]***, PUCCH, SR, and SRS.

Ex. 1005 (Lee '328) ¶¶ 42, 44; Ex. 1004 (Lee), 22:25-33.

220. A POSITA understood that downlink control channels, such as EPDCCH, transmit downlink control information to UE/MTC. Ex. 1006 (Zhang), 15:22-24 (“[T]he dynamic offset modifier is derived based on ***downlink control information DCI that EPDCCH is carrying.***”).

221. Thus, Lee in view of Zhang renders obvious limitation [1.2].

iv. [1.3] receiving the downlink data; and

222. Lee discloses this limitation. Lee discloses receiving downlink data (*downlink; data received via PDSCH*) on a physical downlink shared channel (PDSCH):

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In decoupled operation arrangement (e.g., assuming DL transmissions from the Macro and UL transmissions to the LPN), ***upon the reception of the Physical Downlink Shared Channel (PDSCH)*** by the UE, the UE may send the corresponding Hybrid Automatic request (HARQ) feedback to the LPN.

Ex. 1005 (Lee '328) ¶ 38, FIG. 2; Ex. 1004 (Lee), 61:35-40; FIG. 2.

223. A POSITA understood that by receiving the PDSCH, a UE would be receiving downlink data, as claimed. Accordingly, Lee discloses limitation [1.3].

- v. ***[1.4] transmitting the response information on the downlink data by using the resource allocated to the uplink control channel,***

224. Lee in combination with Zhang discloses this limitation. Upon reception of downlink data on a PDSCH, Lee discloses transmitting response information (*HARQ feedback*):

In decoupled operation arrangement (e.g., assuming DL transmissions from the Macro and UL transmissions to the LPN), upon the reception of the Physical Downlink Shared Channel (PDSCH) by the UE, ***the UE may send the corresponding Hybrid Automatic reQuest (HARQ) feedback to the LPN. The LPN may communicate the feedback to the serving eNB which may have sent the corresponding PDSCH.***

Ex. 1005 (Lee '328) ¶ 38; Ex. 1004 (Lee), 61:35-42.

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225. Lee further discloses transmitting this response information on a resource allocated to the uplink control channel (*PUCCH*) that is predetermined:

Legacy *PUCCH*-based HARQ ACK/NACK may be provided. The UE may not send PDSCH HARQ ACK/NACK bits (e.g., via *PUCCH*) in each UL subframe. The UE may receive a configuration parameter indicating the subframes the UE may use to send PDSCH HARQ ACK/NACK bits (e.g., via *PUCCH*). ***The UE may receive a configuration parameter, e.g., a parameter r which may indicate that each r -th subframe may include *PUCCH* resources allocated to the UE and/or the UE may transmit PDSCH HARQ ACK/NACK bits (e.g., via *PUCCH*) in those subframes.***

Ex. 1005 (Lee '328) ¶91; Ex. 1004 (Lee), 64:5-14.

226. Further, when the teachings of Lee are combined with those of Zhang, a POSITA understood that an MTC would transmit the response information (*HARQ feedback*) using the allocated resource (*PUCCH*):

Figure 8 is a flow chart illustrating an exemplary embodiment. The apparatus 401, which may comprise e.g. a network element (network node 401, e.g. a LTE base station, eNB) transmits, in item 802, to another network element (network node 402, e.g. a user terminal, UE) a configuration signal for configuring UE 402 to transmit a HARQ-

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ACK signal by utilizing a PUCCH format 1 a/b resource for EPDCCH signaling in TDD. The configuration signalling transmitted in item 802 may be e.g. dedicated higher layer signalling. ***Before transmitting the signalling in item 802, eNB 401 15 may configure the resources in item 801. In item 803, eNB 401 may receive the HARQ-ACK signalling transmitted from UE 401 by utilizing the configured PUCCH format 1 a/b resource for EPDCCH signalling in TDD.***

Ex. 1006 (Zhang), 14:8-17.

227. Zhang expressly discloses that an eNB allocates the PUCCH resources via signaling at 802 and then receives HARQ feedback from the UE on the allocated resource at 803. Ex. 1006 (Zhang), 14:8-17 (above).

228. Lee in combination with Zhang thus discloses limitation [1.4].

- vi. ***[1.5] wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;***

229. Lee in combination with Zhang discloses this limitation. For example, an MTC/UE receives a configuration parameter (*start offset information*), which

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indicates which uplink subframes (*PUCCH*) to use in a transmission of response information (*PDSCH HARQ ACK/NACK*):

The UE may not send *PDSCH HARQ ACK/NACK* bits (e.g., via *PUCCH*) in each UL subframe. The UE may receive a configuration parameter indicating the subframes the UE may use to send *PDSCH HARQ ACK/NACK* bits (e.g., via *PUCCH*). ***The UE may receive a configuration parameter, e.g., a parameter r which may indicate that each r -th subframe may include *PUCCH* resources allocated to the UE and/or the UE may transmit *PDSCH HARQ ACK/NACK* bits (e.g., via *PUCCH*) in those subframes.***

Ex. 1005 (Lee '328) ¶ 91; Ex. 1004 (Lee), 64:4-14.

230. As mentioned above, Lee does not expressly disclose how the configuration parameter or the corresponding resources are determined/allocated, but Zhang does. XI.B.1.

231. Zhang discloses a formula, $n^{(1)}_{\text{PUCCH}} = n_{\text{eCCE}} + N^{(1)}_{\text{UE-PUCCH}} + k$, which includes start offset information ($N^{(1)}_{\text{UE-PUCCH}}$ and k):

$N^{(1)}_{\text{UE-PUCCH}}$ is **UE- and EPDCCH-set-specific *PUCCH* resources offset** configured by higher layers (via a protocol layer higher than the physical layer), and k is a ***dynamic offset modifier*** such as an antenna port-specific offset associated with antenna port p , where p is the

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antenna port allocated to the first CCE of corresponding EPDCCH or
other explicitly signaled or implicitly derived parameter.

Ex. 1006 (Zhang), 6:25-33.

232. Because this claim element includes the language “at least one of”, only one of the three listed requirements must be disclosed. Accordingly, Lee in view of Zhang discloses claim element [1.5].

233. While limitation [1.5] only requires disclosure of one of the three alternatives due to the “at least one of” language, Lee in view of Zhang also discloses the other two. Specifically, the formula disclosed in Zhang also includes information on a resource of a downlink control channel for scheduling the downlink data (n_{eCCE}):

n_{eCCE} is the index of the lowest eCCE of the detected EPDCCH carrying
the DL assignment....

Ex. 1006 (Zhang), 15:21-24.

234. Further Lee discloses a configuration parameter which corresponds to the information on the resource allocated to the uplink control channel (*a parameter r which may indicate that each r -th subframe may include PUCCH resources allocated to the UE*). Ex. 1005 (Lee '328) ¶ 91; Ex. 1004 (Lee), 64:4-14.

235. Thus, Lee in view of Zhang discloses limitation [1.5].

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- vii. ***[1.6] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal;***

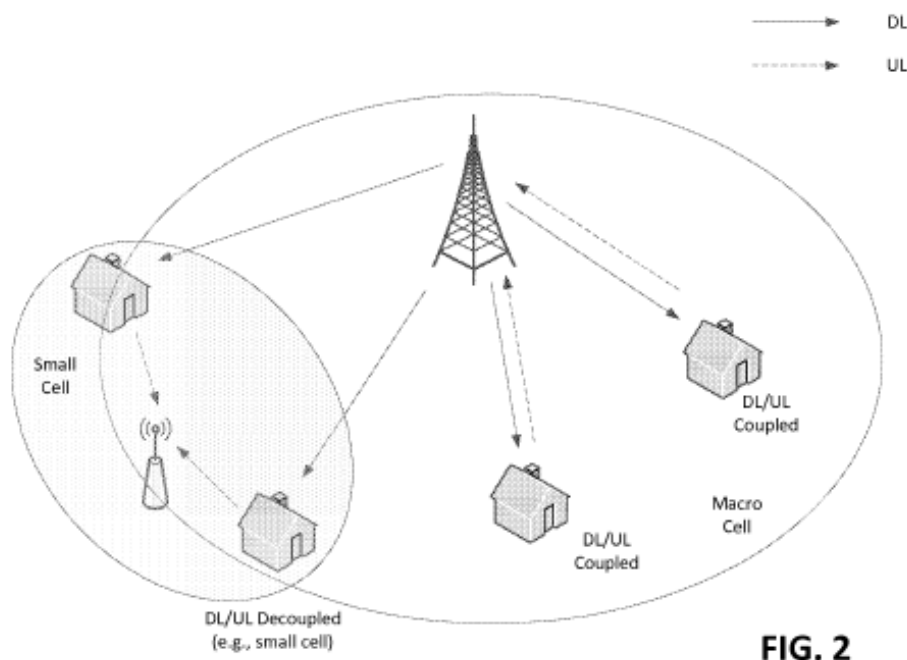
236. Lee in view of Zhang discloses this limitation. Lee discloses that an MTC terminal (*LC-MTC device*) may operate in “decoupled” mode in which the MTC terminal utilizes LPNs. Ex. 1005 (Lee ’328) ¶ 27, FIG. 2. In decoupled mode, the MTC terminal (*LC-MTC device*) uses start offset information, which is configured separated from start offset information for another MTC operating in “coupled mode” or a traditional LTE terminal, either of which that would communicate directly with an eNB/Macro cell:

Mechanisms for communicating provided for connecting the regular devices may not be adequate for the LC-MTC devices.

Ex. 1005 (Lee ’328) ¶ 1.

As illustrated in FIG. 2, in DL/UL coupled case, an LC-MTC device may communicate with a Macro cell for uplink and/or downlink. ***In DL/UL decoupled case, an LC-MTC device may communicate with Macro cell for downlink while transmitting uplink signal to low power node (LPN).***

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Ex. 1005 (Lee '328) ¶ 80, FIG. 2; Ex. 1004 (Lee), 10:28-33, FIG. 2.

In decoupled operation arrangement ... [t]he timing requirement for eNB to receive the PDSCH HARQ feedback may not be sufficient due to the extra LPN processing and further communication and/or communication delay between LPN and eNB. The eNB may not be able to inform the LPN of the transmission of the PDSCH and the LPN may not expect to receive the PDSCH-related feedback when they are sent by the UE. Such an arrangement may make it difficult for the LPN to properly receive and/or decode a feedback. An improved HARQ operation may be provided.

Ex. 1005 (Lee '328) ¶38; Ex. 1004 (Lee), 61:35-51.

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237. Given this timing issue, Lee discloses calculating a time and frequency offset (i.e. start offset information) for an LPN which is relative to (and thus separated from) a Macro cell:

A UE may determine the ***time and frequency offset of a LPN with respect to the Macro cell***. The UE may report to the LPN the offset values, e.g., if the offsets are greater than a threshold value... A UE may maintain separate timing and/or frequency offsets for UL and/or DL transmissions.

Ex. 1005 (Lee '328) ¶ 82; Ex. 1004 (Lee), 57:9-20. These offsets are configured by the Macro Cell over an X2 interface:

A Macro cell may configure one or many LPNs with the one or more parameters to receive a broadcasted PRACH preamble by a UE that may experience poor UL coverage to the Macro cell. ***The configuration may be provided over X2 interface***. The contents of the configuration may include one or more of a set of preambles, ***one or more time/frequency resources***, or transmission power characteristics.

Ex. 1005 (Lee '328), ¶ 76; Ex. 1004 (Lee), 53:65-54:7.

238. A POSITA would have understood that this X2 interface reduces delay and allows for standard operations such as data and voice.

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239. Thus, the start offset of the resource allocated to an uplink control channel for an MTC terminal (*LC-MTC device*) in decoupled mode is calculated relative to (and thus different from) an offset of a terminal operating in coupled mode in a Macro cell. These disclosures of Lee are consistent with those in Zhang, which expressly contemplates providing UE-specific PUCCH resources for transmitting HARQ ACK/NACK.

In the case of FDD, the PUCCH format 1 a/1 b HARQ-ACK resource in response to EPDCCH scheduled PDSCH may be described with the following formula (RAN 1 #70 agreement):

$$n^{(1)}_{\text{PUCCH}} = n_{\text{eCCE}} + N^{(1)}_{\text{UE-PUCCH}} + k,$$

....

where $N^{(1)}_{\text{UE-PUCCH}}$ is ***UE- and EPDCCH-set-specific PUCCH resources offset*** configured by higher layers (via a protocol layer higher than the physical layer) ...

Ex. 1006 (Zhang), 6:21-33.

In an exemplary embodiment, a single semi-static ***UE-specific resource*** starting offset $N^{(1)}_{\text{UE-PUCCH}}$ may be configured for each EPDCCH set assuming $M=1$.

Ex. 1006 (Zhang), 7:12-24.

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In an exemplary embodiment, the resource allocation formula for TDD may be described using the notation from a 3GPP specification as:

$$n^{(1)}_{\text{PUCCH}} = N^{(1)}_{\text{UE-PUCCH-TDD}} * m + n_{\text{eCCE}} + N^{(1)}_{\text{UE-PUCCH}} + k$$

where $N^{(1)}_{\text{UE-PUCCH-TDD}}$ is a parameter specific for a TDD operation.

Ex. 1006 (Zhang), 8:10-24.

According to yet another exemplary embodiment, for time division duplex signalling when $M > 1$, ***the second user terminal-specific resource offset impacts resource allocation*** when PUCCH HARQ-ACK resources for multiple downlink subframes map into a single uplink subframe.

Ex. 1006 (Zhang), 15:9-12.

240. Indeed, a POSITA would have understood that the MTC/UE-specific PUCCH resources would include start offset information for an MTC terminal that would be configured separated from start offset information for a terminal (e.g., UE/MTC) different from the MTC terminal.

241. Thus, Lee in view of Zhang discloses limitation [1.6].

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viii. ***[1.7] wherein a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station;***

242. Lee in view of Zhang discloses this limitation. Lee discloses that the configuration of LPN cells is provided, specific for each UE, via higher layer signaling:

The configuration of LPN cells may be used for UL transmission. The configuration may be ***UE-specific and may be provided, e.g., via higher layer signaling to UEs*** that have Macro cell access.

Ex. 1005 (Lee '328) ¶ 64; Ex. 1004 (Lee), 43:43-50.

A UE may determine time and frequency offset of a LPN with respect to the Macro cell...The UL synchronization may be obtained as an offset value of the DL synchronization values. ***The offsets to use may be provided by the Macro cell, e.g., via higher layer signaling.***

Ex. 1005 (Lee '328) ¶ 82; Ex. 1004 (Lee), 57:27-34.

243. Zhang, like Lee, discloses receiving a PUCCH resources offset and a dynamic offset modifier (*plurality of start offset information*) through higher level signaling (*RRC signaling*):

$$n^{(1)}_{\text{PUCCH}} = n_{\text{eCCE}} + N^{(1)}_{\text{UE-PUCCH}} + k,$$

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....

$N_{\text{UE-PUCCH}}^{(1)}$ is **UE- and EPDCCH-set-specific PUCCH resources offset** configured by **higher layers** (via a protocol layer higher than the physical layer), and k is a ***dynamic offset modifier*** such as an antenna port-specific offset associated with antenna port p , where p is the antenna port allocated to the first CCE of corresponding EPDCCH or other explicitly signaled or implicitly derived parameter.

Ex. 1006 (Zhang), 6:25-33.

244. Zhang further discloses transmitting configuration information through a configuration signal, which is transmitted through higher level signaling (*RRC signaling*):

The signaling chart of Figure 6 illustrates the required signaling. In the example of Figure 6, a network node 401 (which may comprise e.g. a LTE-capable base station (eNode-B, eNB)) used to configure may transmit a configuration signal 602 to a user terminal 402 (UE), for configuring UE 402 to transmit a HARQ-ACK signal 606 by utilizing a PUCCH format 1 a/b resource for EPDCCH signaling in TDD. ***This signaling 602 may be e.g. dedicated higher layer (i.e. higher than L1) signaling (e.g. RRC signaling).***

....

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In step 605, UE 402 applies the resource allocation formula based on the configured parameters and the eCCE index . The formula gives as an output an UL (PUCCH) resource by which the HARQ-ACK 606 is transmitted from UE 402 to eNB 401.

Ex. 1006 (Zhang), 13:18-25.

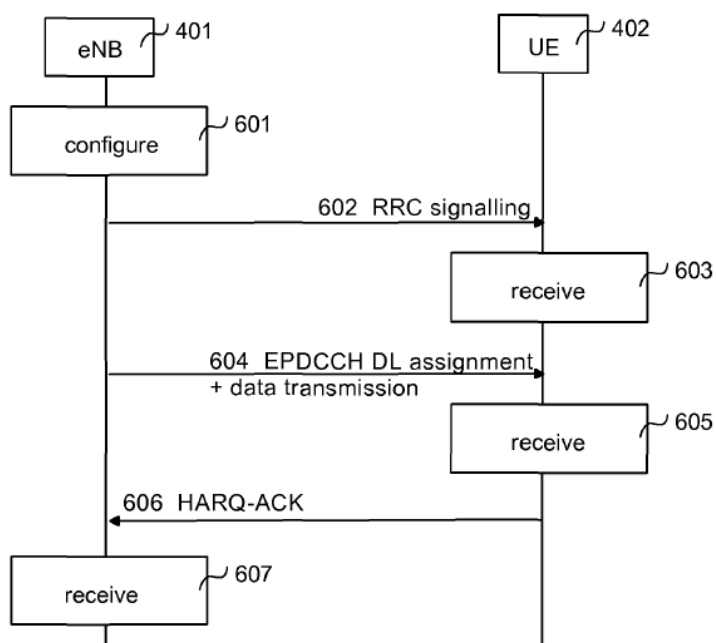


Fig. 6

Ex. 1006 (Zhang), FIG. 6.

245. Finally, Zhang discloses that the starting offset may be configured as a UE-specific (*cell-specific*) value for each EPDCCH set:

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In an exemplary embodiment, a single semi-static UE-specific resource starting offset $N(1)UE\text{-}PUCCH$ may be configured for each EPDCCH set assuming $M=1$.

Ex. 1006 (Zhang), 7:12-13.

246. Thus, Lee in view of Zhang discloses limitation [1.7].

ix. [1.8] wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and

247. Lee discloses this limitation. As discussed above with respect to limitation [1.6], a UE may operate in a decoupled state where it may uplink to an LPN. XI.B.2.a.vii. Moreover, the start offset information (*time and frequency offset information*) on the resource allocated to the uplink control channel (*PUCCH*) is determined based on a UE uplink transmission to a LPN cell. XI.B.2.a.vii.

248. Lee further discloses that an LPN will be chosen for transmission based on a coverage level of a UE/MTC (*decoupled mode used when LC-MTC is in a limited lower coverage level*):

A Low-cost UE may discover an LPN, e.g., for UL transmissions. ***Such a Low-cost UE may determine that it may be better served in a decoupled manner*** and may thus trigger discovery of such LPN cells.

Ex. 1005 (Lee '328) ¶ 61.

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As illustrated in FIG. 2, in DL/UL coupled case, an LC-MTC device may communicate with a Macro cell for uplink and/or downlink. ***In DL/UL decoupled case, an LC-MTC device may communicate with Macro cell for downlink while transmitting uplink signal to low power node (LPN).***

Ex. 1005 (Lee '328) ¶ 28.

The coverage limited LC-MTC device may be assumed to start with a coupled mode and transition into a decoupled mode (e.g., using the uplink of the LPN) for better uplink coverage. In case the coverage LC-MTC device may not have uplink coverage with Macro so that the device may start with LPN.

Ex. 1005 (Lee '328) ¶ 29; Ex. 1004 (Lee), 42:61-65, 10:28-42.

249. Lee therefore discloses determining transmission to an LPN (and thus a particular determination of start offset information) based on a coverage level.

250. Thus, Lee discloses limitation [1.8].

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- x. ***[1.9] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.***

251. Lee discloses this limitation. Lee explicitly discloses utilizing repeated transmissions when in coverage limited mode:

The coverage limited mode of operation may include use of coverage enhancement transmission schemes ***such as repetitions***, TTI bundling, and/or PSD boosting of data and/or control channels.

Ex. 1005 (Lee '328) ¶ 46; Ex. 1004 (Lee), 30:18-26.

252. Lee further discusses utilizing different repetitions based on coverage levels:

For different coverage limitation level, the coverage limited mode of operation may be configured, e.g., configured separately for downlink and uplink. For example, ***the number of repetition for PDSCH for coverage enhancement may be separately configured with the number of repetitions for PUSCH for coverage enhancement.***

Ex. 1005 (Lee '328) ¶46; Ex. 1004 (Lee), 30:20-26.

253. As discussed above, repeated transmission of a PUCCH resource for HARQ ACK/NACK using a single, identical PUCCH resource in each subframe

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was well known in the art by September 2013. VI.D; XI.A.2.a.x. Repeated transmission of PUCCH was also a well understood means of achieving coverage enhancement. VI.E.1. As the '931 Patent acknowledges, MTC terminals often operate in areas with relatively poor radio wave environments. Ex. 1001 ('931 Patent), 1:33-37; Ex. 1005 (Lee '328) ¶ 1; Ex. 1004 (Lee), 1:19-31. A POSITA understood the benefits of repeatedly transmitting a HARQ ACK/NACK to ensure reception. Thus, a POSITA would utilize the well-known method of repeatedly transmitting HARQ ACK/NACK through PUCCH over multiple subframes. VI.D.

254. Therefore, Lee discloses limitation [1.9]. Thus, for at least the foregoing reasons, Lee in view of Zhang renders obvious claim 1 of the '931 Patent.

b. Claim 2

- i. [2.] The method of claim 1, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.*

255. Lee in view of Zhang renders obvious claim 1 for reasons discussed above in XI.B.2.a.

256. Further, as discussed above, Lee discloses that an LPN will be chosen for transmission based on a coverage level of a UE/MTC. XI.B.2.a.ix. Lee further discloses that the difference in timing of transmitting the response information between the LPN (used for low coverage level UEs) and the Macro cell (used for

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higher coverage level UEs) may include start offset information (*timing and frequency offset*):

The Macro may indicate to the LPNs one or more of an C-RNTI used by the Macro, a pathloss to the Macro, *a timing and frequency offset* of the Macro, or security keys used by the UE at the Macro cell.

Ex. 1005 (Lee '328) ¶ 77; Ex. 1004 (Lee), 54:23-29.

257. Accordingly, Lee in view of Zhang renders obvious claim 2 of the '931 Patent.

c. Claim 3

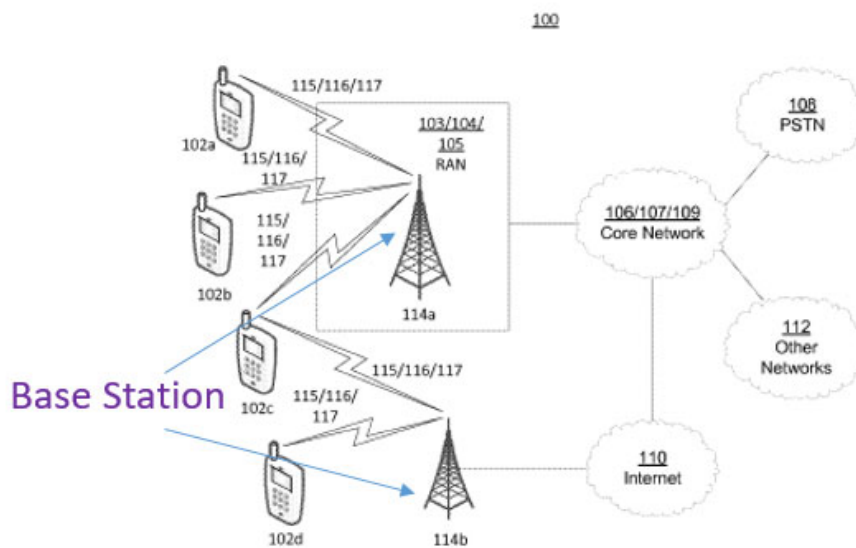
i. [3.0] A method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station, the method comprising:

258. To the extent the preamble is limiting, Lee discloses this claim element. As shown above in discussing limitation [1.0], Lee discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. XI.B.2.a.i. Lee further discloses that a base station performs the disclosed method:

The communications systems 100 may also include a base station 114a and a base station 114b.

Ex. 1005 (Lee '328) ¶ 10; Ex. 1004 (Lee), 3:20-21.

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Ex. 1005 (Lee '328), FIG. 1A; Ex. 1004 (Lee), FIG. 1A.

259. To the extent the preamble is limiting, Lee thus discloses limitation [3.0].

- ii. [3.1] transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;***

260. Lee in combination with Zhang discloses this limitation for the same reasons as set forth above in limitation [1.1]. XI.B.2.a.ii.

- iii. [3.2] transmitting downlink control information for scheduling the downlink data; and***

261. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [1.2]. XI.B.2.a.iii. Indeed limitation 1.2 requires the

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reception (and thus corresponding transmission) of downlink control information for scheduling the downlink data.

iv. [3.3] transmitting the downlink data,

262. Lee discloses this limitation for the same reasons as set forth above in limitation [1.3]. XI.B.2.a.iv. Indeed limitation 1.3 requires the reception (and thus corresponding transmission) of downlink data.

v. [3.4] wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on: i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel;

263. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [1.5]. XI.B.2.a.vi. Indeed, limitation 1.5 requires the resource of the uplink control channel to be determined based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel.

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- vi. [3.5] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;***

264. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [1.6]. XI.B.2.a.vii. Indeed limitation 1.6 requires the start information of the resource allocated to the uplink channel be configured separated from offset information on a terminal different from the MTC terminal.

- vii. [3.6] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;***

265. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [1.7]. XI.B.2.a.viii. Indeed limitation 1.7 requires a plurality of pieces of start offset information on the resource allocated to the uplink control channel be provided and received (and correspondingly transmitted) through cell-specific high layer signaling for the MTC terminal from the base station (and correspondingly to the MTC terminal).

- viii. [3.7] wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and***

266. Lee discloses this limitation for the same reasons as set forth above in limitation [1.8]. XI.B.2.a.ix. Indeed limitation 1.8 requires the start offset

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information on the resource allocated to the uplink control channel be determined based on a coverage level.

- ix. ***[3.8] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.***

267. Lee discloses this limitation for the same reasons as set forth above in limitation [1.9]. XI.B.2.a.x. Indeed limitation 1.9 requires the response information of the downlink data of the MTC terminal be repeatedly transmitted and the repeated transmission be performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

268. Therefore, for at least the foregoing reasons, Lee in view of Zhang renders obvious claim 3 of the '931 Patent.

d. Claim 4

- i. ***[4.] The method of claim 3, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.***

269. Lee in view of Zhang renders obvious claim 3 for reasons discussed above in XI.A.2.c. Lee discloses this claim for the same reasons as set forth above with respect to claim 2. XI.B.2.b. Indeed claim 2 requires at least one of the plurality

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of pieces of start offset information be applied according to a corresponding coverage level of the MTC terminal.

270. Accordingly, Lee in view of Zhang renders obvious claim 4 of the '931 Patent.

e. Claim 5

i. [5.0] A Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station, the terminal comprising:

271. To the extent the preamble is limiting, Lee discloses this claim element. As discussed above in [1.0], Lee discloses a Machine Type Communication (MTC) terminal configured to receive downlink data and transmit response information. XI.B.2.a.i. Further, Lee discloses a base station capable of receiving a signal:

The communications systems 100 may also include ***a base station 114a and a base station 114b.***

Ex. 1005 (Lee '328) ¶ 10.

The base station 114a and/or the base station 114b may be configured to transmit and/or receive wireless signals within a particular geographic region, which may be referred to as a cell (not shown).

Ex. 1005 (Lee '328) ¶ 11; Ex. 1004 (Lee), 3:20-21, 3:39-42.

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272. To the extent the preamble is limiting, Lee thus discloses limitation [5.0].

- ii. ***[5.1] a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data;***

273. Lee in view of Zhang discloses this limitation. Lee discloses a receiving unit (**transceiver 120**):

As shown in FIG. 1B, the WTRU 102 may include a processor 118, **a transceiver 120**, a transmit/receive element 122, ...

Ex. 1005 (Lee '328) ¶ 17; Ex. 1004 (Lee), 5:15-18.

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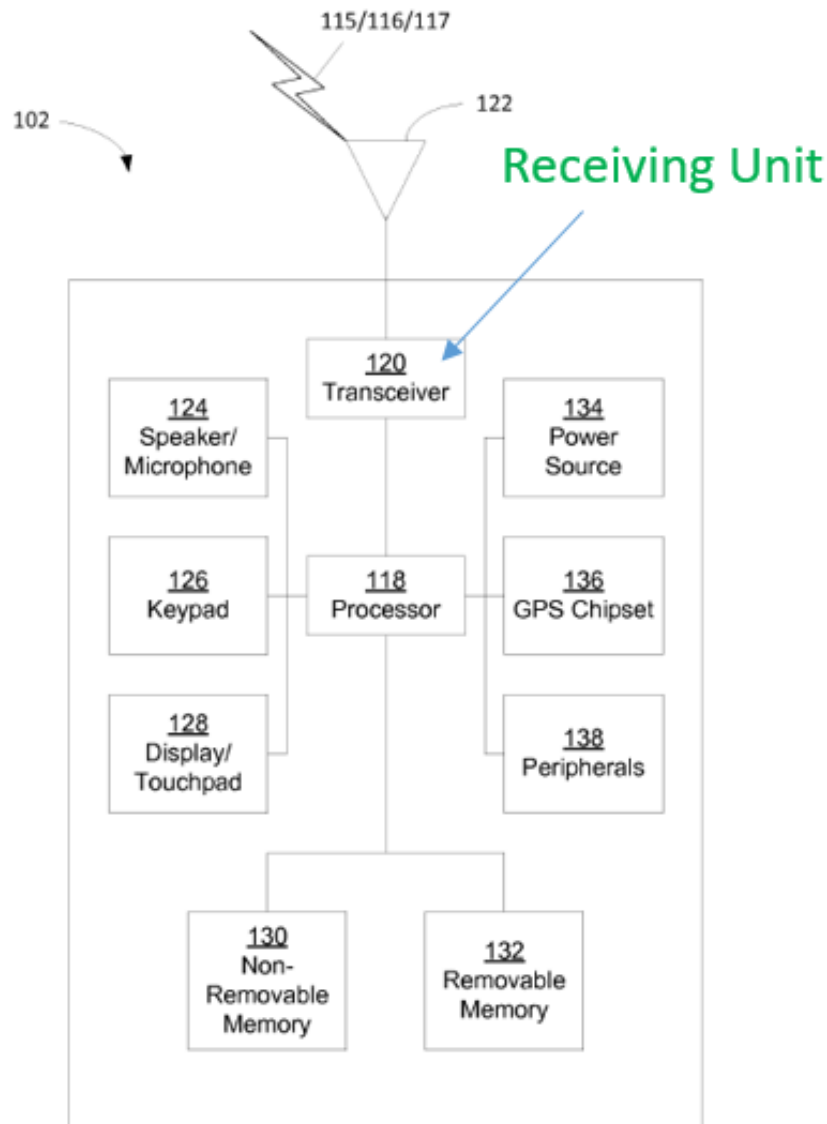


FIG. 1B

Ex. 1005 (Lee '328), FIG. 1B; Ex. 1004 (Lee), FIG. 1B.

274. Lee in view of Zhang discloses the remainder of the limitation for the same reasons as set forth above in limitations [1.1]-[1.3]. XI.B.2.a.ii-XI.B.2.a.iv. Indeed limitation [1.1] requires receiving structural information that contains at least

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one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. Limitation [1.2] requires receiving downlink control information for scheduling the downlink data. And limitation [1.3] requires receiving downlink data.

iii. [5.2] a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel; and;

275. Lee in view of Zhang discloses this limitation. Lee discloses a controller ([processor 118](#)):

As shown in FIG. 1B, the WTRU 102 may include ***a processor 118***, a transceiver 120, a transmit/receive element 122, ...

Ex. 1005 (Lee '328) ¶ 17; Ex. 1004 (Lee), 5:15-18.

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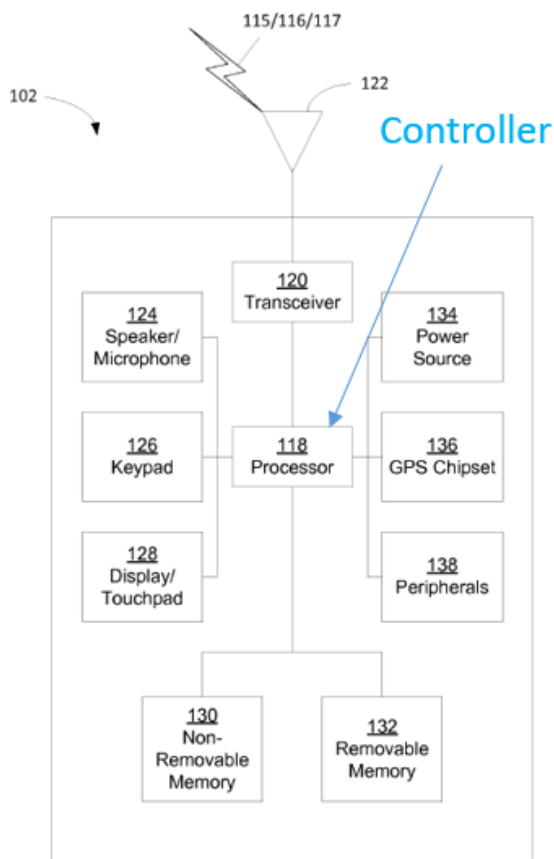


FIG. 1B

Ex. 1005 (Lee '328), FIG. 1B; Ex. 1004 (Lee), FIG. 1B.

276. Lee in view of Zhang discloses the remainder of this limitation for the same reasons as set forth above in limitation [1.5]. XI.B.2.a.vi. Indeed limitation 1.5 requires the resource allocated to the uplink control channel be determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel.

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- iv. ***[5.3] a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel,***

277. Lee in view of Zhang discloses this limitation. Lee discloses a transmitting unit (**transceiver 120**):

As shown in FIG. 1B, the WTRU 102 may include a processor 118, **a transceiver 120**, a transmit/receive element 122, ...

Ex. 1005 (Lee '328) ¶ 17; Ex. 1004 (Lee), 5:15-18.

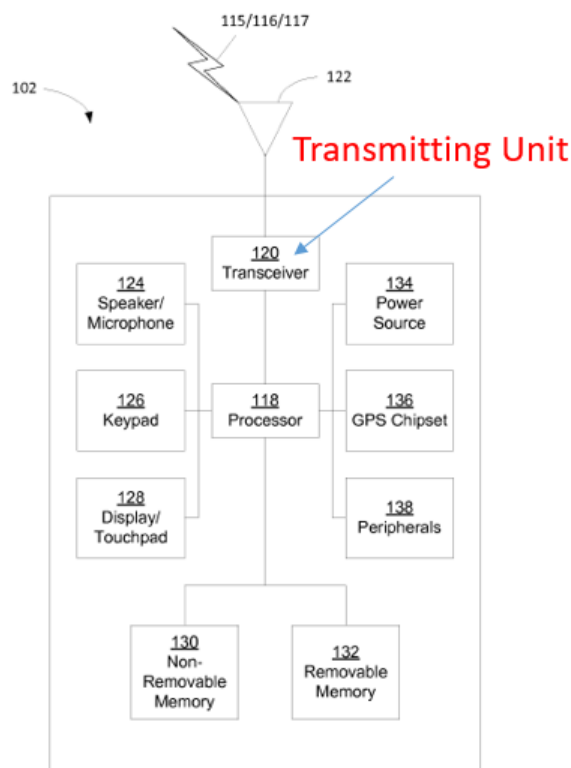


FIG. 1B

EX. 1005 (Lee '328), FIG. 1B; Ex. 1004 (Lee), FIG. 1B.

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278. Lee in view of Zhang discloses the remainder of this limitation for the same reasons as set forth above in limitation [1.4]. XI.B.2.a.v. Indeed limitation 1.4 requires transmitting the response information on the downlink data by using the resource allocated to the uplink control channel.

- v. [5.4] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;***

279. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [1.6]. XI.B.2.a.vii. Indeed limitation 1.6 requires the start offset information of the resource allocated to the control channel be configured separated from offset information on a terminal different from the MTC terminal.

- vi. [5.5] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from the base station;***

280. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [1.7]. XI.B.2.a.viii. Indeed limitation [1.7] requires a plurality of pieces of start offset information on the resource allocated to the uplink control channel be provided, and requires the plurality of pieces of start offset information be received through cell-specific high layer signaling for the MTC terminal from the base station.

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- vii. [5.6] wherein the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level; and***

281. Lee discloses this limitation for the same reasons as set forth above in limitation [1.8]. XI.B.2.a.ix. Indeed limitation [1.8] requires the start offset information on the resource allocated to the uplink control channel be determined based on a coverage level.

- viii. [5.7] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.***

282. Lee discloses this limitation for the same reasons as set forth above in limitation [1.9]. XI.B.2.a.x. Indeed limitation [1.9] requires the response information of the downlink data of the MTC terminal be repeatedly transmitted, the repeated transmission being performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

283. Therefore, for at least the foregoing reasons, Lee in view of Zhang renders obvious claim 5 of the '931 Patent.

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f. Claim 6

- i. [6.] The MTC terminal of claim 5, wherein: at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal.*

284. Lee in view of Zhang renders obvious claim 5 for reasons discussed above in XI.A.2.e.

285. Lee discloses claim 6 for the same reasons as set forth above with respect to claim 2. XI.B.2.b. Indeed claim 2 requires at least one of the plurality of pieces of start offset information be applied according to a corresponding coverage level of the MTC terminal.

286. Accordingly, Lee in view of Zhang renders obvious claim 6 of the '931 Patent.

g. Claim 7

- i. [7.0] A base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal, the base station comprising:*

287. To the extent the preamble is limiting, Lee discloses this limitation. As shown above in discussing limitation [1.0], Lee discloses a method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. XI.B.2.a.i. Lee further discloses a base station capable of configuring a resource for uplink:

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The communications systems 100 may also include *a base station 114a and a base station 114b.*

Ex. 1005 (Lee '328) ¶ 10.

As illustrated in FIG. 2, in DL/UL coupled case, an LC-MTC device may **communicate with a Macro cell for uplink** and/or downlink. In DL/UL decoupled case, an LC-MTC device may communicate with Macro cell for downlink while **transmitting uplink signal to low power node (LPN).**

Ex. 1005 (Lee '328) ¶ 26; Ex. 1004 (Lee), 3:20-21, 10:28-33.

288. To the extent the preamble is limiting, Lee thus discloses limitation [7.0].

- ii. ***[7.1] transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data;***

289. Lee in view of Zhang discloses this limitation. As discussed above, Lee discloses a transmitting unit:

290. Lee discloses this limitation. Lee discloses a transmitting unit **(transceiver 120):**

As shown in FIG. 1B, the WTRU 102 may include a processor 118, **a transceiver 120**, a transmit/receive element 122, ...

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Ex. 1005 (Lee '328) ¶ 17; Ex. 1004 (Lee), 5:15-18.

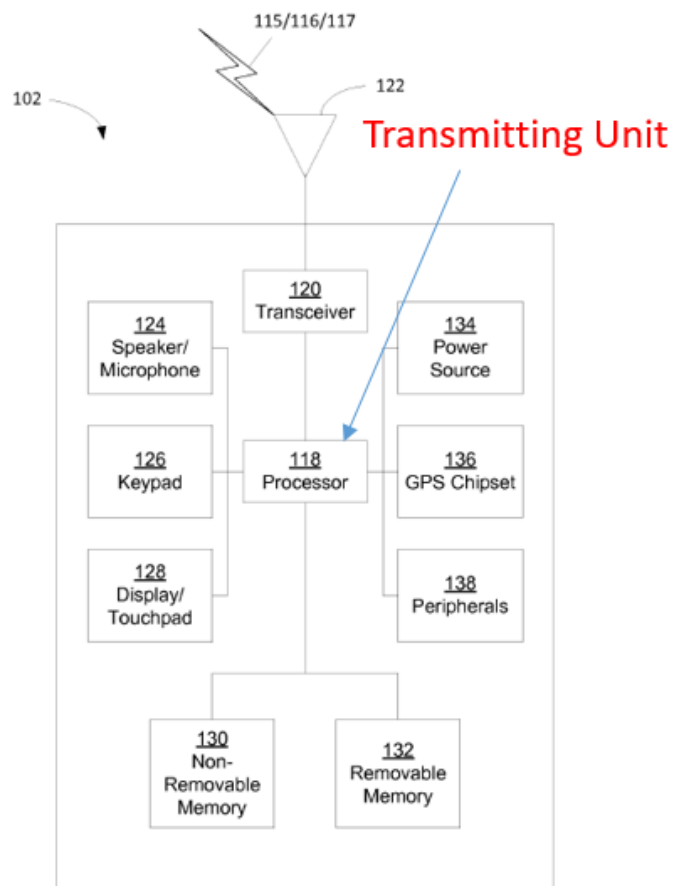


FIG. 1B

Ex. 1005 (Lee '328), FIG. 1B; Ex. 1004 (Lee), FIG. 1B; XI.B.2.e.iv.

291. Further as discussed above in connection with limitations [3.1]-[3.3], Lee in view of Zhang discloses the transmission of structural information, downlink control information for scheduling the downlink data, and the downlink data. XI.B.2.c.ii-XI.B.2.c.iv.

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- iii. [7.2] wherein the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel;***

292. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitations [5.1]. XI.A.2.e.ii. Indeed limitation 5.1 requires the structural information contain at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data.

- iv. [7.3] wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information of the resource allocated to the uplink control channel;***

293. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [3.4]. XI.B.2.c.v. Indeed limitation [3.4] requires the resource of the uplink control channel for transmitting the response information of the downlink data be determined based on at least one piece of information on: i) a

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resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel.

- v. ***[7.4] wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal;***

294. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [3.5]. XI.B.2.c.vi. Indeed limitation [3.5] requires the start offset information of the resource allocated to the uplink control channel be configured separated from offset information on a terminal different from the MTC terminal.

- vi. ***[7.5] wherein a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal;***

295. Lee in view of Zhang discloses this limitation for the same reasons as set forth above in limitation [3.6]. XI.B.2.c.vii. Indeed limitation [3.6] requires a plurality of pieces of start offset information on the resource allocated to the uplink control channel be provided, and requires the plurality of pieces of start offset

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information be transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal.

vii. [7.6] wherein the start offset information of the resource allocated to the uplink control channel is determined based on a coverage level; and

296. Lee discloses this limitation for the same reasons as set forth above in limitation [3.7]. XI.B.2.c.viii. Indeed limitation [3.7] requires the start offset information on the resource allocated to the uplink control channel be determined based on a coverage level.

viii. [7.7] wherein when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

297. Lee discloses this limitation for the same reasons as set forth above in limitation [3.8]. XI.B.2.c.ix. Indeed limitation [3.8] requires the response information of the downlink data of the MTC terminal be repeatedly transmitted, and requires the repeated transmission be performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted.

298. Therefore, for at least the foregoing reasons, Lee in view of Zhang renders obvious claim 7 of the '931 Patent.

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XII. CONCLUSION

299. For at least the reasons addressed above, it is my opinion that every claim of the '931 Patent is invalid as obvious.

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

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

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

Executed on: November 25, 2024

Mark R. Lanning
Mark R. Lanning