

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.
Petitioner

v.

G+ COMMUNICATIONS, LLC
Patent Owner

Patent No. 10,448,430

**DECLARATION OF DR. ZHI DING
IN SUPPORT OF PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 10,448,430**

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I, Zhi Ding, declare as follows:

I. INTRODUCTION

1. I have been retained as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) regarding U.S. Patent No. 10,448,430 (“the ’430 patent”) (Ex. 1001).¹ I have been asked to consider whether prior art references disclose or suggest the features recited in claims 1-15, 17, and 18 (“the challenged claims”) of the ’430 patent. My opinions are set forth below.

2. I am being compensated at my customary rate of \$740/hour for my work in this proceeding. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

3. My qualifications are stated more fully in my curriculum vitae, attached as Ex. 1003. Below is a summary of my education, work experience, and other qualifications.

¹ In this Declaration, I refer to exhibits that I understand are to be attached to the petition for *Inter Partes* Review of the ’430 patent.

4. I presently hold the title of Distinguished Professor in the Department of Electrical and Computer Engineering at the University of California, Davis (UC Davis). Since my appointment on July 1, 2020, I have held the position of Professor for the past 22 years at UC Davis. Since my PhD degree awarded in 1990, I have served as a faculty member at several US universities for over 32 years. I am also a private technical consultant on various technologies related to information systems. I have more than three decades of research experience on a wide range of topics related to data communications and signal processing.

5. I earned my Bachelor of Engineering degree in 1982 in wireless engineering from the Nanjing Institute of Technology (later renamed as Southeast University) in Nanjing, China. I earned my Master of Applied Science degree in 1987 in electrical engineering from the University of Toronto in Toronto, Canada. I earned my Ph.D. in 1990 in electrical engineering from Cornell University in Ithaca, New York.

6. My responsibilities as a Professor at University of California, Davis, include classroom instruction on various topics of communication systems and signal analysis, as well as mentoring undergraduate students and supervising graduate students in their research and development efforts on various topics related to digital communications. I have directly supervised such research and

development works ranging from signal detection to wireless networking. As the chief academic advisor, I have also directly supervised the completion of over 20 Masters theses and more than 30 Ph.D. dissertations on various topics related to digital communications and or signal processing. I have served full time as a faculty member at three major research universities in the United States over the past 30 years, including Auburn University from 1990 to 1998, University of Iowa from 1999 to 2000, and University of California, Davis, from 2000 to present.

7. Since 1990, I have been selected as the principal investigator of multiple highly competitive federal and local research grants, including more than twenty major research projects supported by the National Science Foundation and two research projects funded by the U.S. Army Research Office. These competitive research projects focused on developing more efficient and effective digital communication transceivers, networks, and signal processing tools. I have also participated in several large-scale projects supported by the Defense Advanced Research Projects Agency (DARPA) with teams of researchers. I have applied for, and received support from, other federal, state, and industry sponsors.

8. I have published over 210 peer-reviewed research articles in premier international journals, in addition to over 240 refereed technical articles at top international conferences on communications and information technologies.

According to Google Scholar, my published works have been cited over 15,000 times by peers. I also authored two books on communications technologies. My most recent book, coauthored with B.P. Lathi, is entitled, “Modern Digital and Analog Communication Systems,” 5th edition, and was published by the Oxford University Press in 2018. The 4th edition of this book (published in 2009) had been widely adopted as an introductory textbook to communication systems.

9. In addition to the over 450 published technical papers that have been cited over 15,000 times according to Google Scholar, I am also co-inventor of four issued U.S. patents on communication technologies.

10. I am a member of the Institute of Electrical and Electronics Engineers (IEEE) and was elevated to the grade of Fellow in January 2003 for contributions made in signal processing for communication. The IEEE is the world’s largest professional society of engineers, with over 400,000 members in more than 160 countries. The IEEE has led the development of many standards for modern digital communications and networking, most notably, the IEEE 802 series of network standards. The IEEE Grade of Fellow is conferred by the Boards of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The total number selected in any one year does not exceed one-tenth of one percent of the total voting Institute membership.

11. I have served the IEEE in the following capacities:

- Chief Information Officer of the IEEE Communications Society from Jan. 2018 to present.
- Chief Marketing Officer of the IEEE Communications Society from Jan. 2020 to present.
- General Chair of the 2016 IEEE International Conference on Acoustics, Speech, and Signal Processing, the flagship conference of the IEEE Signal Processing Society.
- Chair of the Steering Committee for the IEEE Transactions on Wireless Communications from 2008 to 2010.
- Distinguished Lecturer of the IEEE Communications Society from January 2008 to December 2009.
- Technical Program Chair of the 2006 IEEE Globecom, one of two flagship annual IEEE Communication Society conferences.
- Distinguished Lecturer of the IEEE Circuits and Systems Society from 2004 to 2005.
- Associate Editor of the IEEE Transactions on Signal Processing from 1994 to 1997 and from 2001 to 2004.
- Member of the IEEE Statistical Signal and Array Processing for Communications Technical Committee from 1993 to 1998.
- Member of the IEEE Signal Processing for Communications Technical Committee from 1998 to 2004.

12. In 2012, I received the Wireless Communications Technical Committee Recognition Award from the IEEE Communications Society, an award given to a person with a high degree of visibility and contribution in the field of “Wireless and Mobile Communications Theory, Systems, and Networks.” I received the 2020

Education Award from the IEEE Communications Society. According to the Society, this award “recognizes distinguished and significant contributions to education within the Society’s technical scope.”

13. I have also served as a technical consultant for the telecommunication industry. For example, in 1995 I consulted for Analog Devices, Inc., on the development of the first generation DOCSIS cable modem systems. I have also consulted for other companies, including Nortel Networks and NEC US Laboratories. I worked as a visiting faculty research fellow at NASA Glenn Research Center in 1992 and at U.S. Air Force Wright Laboratory in 1993. I have served on multiple review panels of the National Science Foundation to evaluate competitive research proposals in the field of communication. I have also reviewed a large number of research proposals at the request of the National Science and Engineering Research Council (NSERC) of Canada as an expert panelist from 2010 to 2013, and also at the request of the Research Grant Council (RGC) of Hong Kong as an external reviewer.

14. I have served as an expert witness or consulting expert on a number of matters related to intellectual property, mostly in the arena of telecommunications, including cellular communications, Wi-Fi technologies, Bluetooth, and optical

communications. For example, since 2007, I have been engaged to work on various litigations involving cellular, WiFi, Bluetooth, and optical communication networks.

15. Further experience and a complete list of my publications are presented in my curriculum vitae. A copy of my curriculum vitae is attached as Ex. 1003.

16. Based on my above-described near three decades of experience in communications technologies, and the acceptance of my publications and professional recognition by societies in my field, I believe that I am qualified to be an expert in wireless communication systems, communication networks, and signal processing.

17. Based on my experiences described above, and as indicated in my curriculum vitae, I am qualified to provide the following opinions with respect to the patents in this case. Additionally, I was at least a person having ordinary skill in the art as of June 26, 2015.

III. MATERIALS REVIEWED

18. The opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding systems and processes in the field of wireless communication technology.

19. In forming my opinions expressed in this Declaration, I reviewed the following materials:

Ex. 1001	U.S. Patent No. 10,448,430 to Zhang et al. (“the ’430 patent”)
Ex. 1003	Curriculum Vitae of Dr. Zhi Ding, Ph.D.
Ex. 1004	Prosecution History of U.S. Patent No. 10,448,430
Ex. 1005	U.S. Patent Publication No. 2013/0155894A1 (“Li”)
Ex. 1006	Chinese Patent Publication No. 102917433 (“Jiang”), including English translation and translation certificate
Ex. 1007	U.S. Patent No. 10,034,308 to Lee et al. (“Lee”)
Ex. 1011	U.S. Patent Publication No. 2016/0374068 to Kim et al. (“Kim”)
Ex. 1012	U.S. Patent Publication No. 2014/0362794 A1 to Zhao et al. (“Zhao”)

I also considered any other documents and materials I refer to in this Declaration.

20. My opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the state of the art, the prior art, and the claims and the specification of the ’130 patent at the time of the alleged invention, which I discuss below.

21. I have been asked to initially consider that the time of the alleged invention of the ’430 patent was the mid-2010s (including June 26, 2015), which

corresponds to the foreign application priority filing date of the provisional application for '430 patent. (Ex. 1001, Cover.)

22. Based on my experience and expertise, it is my opinion that certain references disclose and/or suggest all the features recited in the challenged claims of the '430 patent, as I discuss in detail below.

IV. PERSON OF ORDINARY SKILL IN THE ART AND THE TIME OF THE ALLEGED INVENTION

23. I am familiar with the level of ordinary skill in the art regarding the '430 patent as what I understand to be around the claimed priority date of June 26, 2015. Considering the '430 patent, the technology, the education level and experience of workers in the field relating to the patent, and problems and solutions in that field, and drawing on my own experience, I believe a person of ordinary skill in the art at the time of the alleged invention (around June 26, 2015) would have had a Bachelor's degree in electrical engineering, computer engineering, computer science, or a related field from an accredited program, along with at least two years of experience in the field of wireless communication technology. More technical education can supplement shorter practical experience and vice versa.

24. My opinions in this Declaration regarding the '430 patent and the prior art (including the state of the art) are from the perspective of one of ordinary skill in

the art as I defined above, during the relevant timeframe (e.g., the time of the alleged invention), which I discussed above as being around June 26, 2015.

V. TECHNICAL BACKGROUND

25. Below, I present a brief overview of certain aspects of systems and processes relating to wireless communication technology prior to and at the time of the alleged invention for the '430 patent. The functionalities and concepts I describe below in this technical background section reflect the state of the art that a person of ordinary skill in the art would have had knowledge of, and understood, prior to and at the time of the alleged invention of the '430 patent. I rely on, and incorporate as applicable (even if not expressly mentioned below in Section IX), the following disclosures and opinions to support my opinions in this declaration, including those opinions relating to how the prior art discloses and/or suggests the challenged claims of the '430 patent and how and why a person of ordinary skill in the art would have been motivated to consider the disclosures and suggestions from that prior art as I explain below in Section IX. The concepts below would have been within the knowledge and mindset of a person of ordinary skill in the art at the time of the alleged invention.

26. The '430 patent is directed at a wireless communication system, in particular, a cellular wireless communication system in which service areas are

divided geographically into coverage cells. Each cell is typically served by a base station in the center.

27. In the 4th generation (4G) cellular standard known as LTE, a base station (BS) is also more commonly known as NodeB, eNB, or eNodeB. A cellular phone known as user terminal or user equipment (UE) located within the cell communicates directly with the serving eNB. Data communications include voice, video, text, images, and other forms of information. A cell contains a plurality of UEs, each in direct communication with the eNB by sending data to the eNB (via uplink channel and by receiving data from eNB (via downlink channel).

28. Before a UE can be connected to wireless network, it performs a random access procedure with an eNB. Random access procedure was a step in cellular networks well known to a person of ordinary skill in the art (POSITA) at the time of the '430 filing. For example, in LTE cellular networks, a "UE performs the random access procedure in the following cases. The UE performs initial access since there is no radio resource control (RRC) connection to an eNB. The UE accesses a target cell for the first time in a handover procedure. The random access procedure is requested by a command from the eNB. Data to be transmitted on uplink is generated while uplink time synchronization is not established, or a designated radio resource used to request a radio resource is not allocated. A

recovery procedure is performed due to radio link failure or handover (HO) failure”.
(Ex. 10011, ¶¶[0065]-[0070].)

29. The basic function of random access is also described in the '430 patent. For example, the BACKGROUND of the '430 patent states that a UE can be scheduled to transmit data on uplink only after random access process. “In the LTE system, a random access is a basic function, and a UE can be scheduled by the system to perform uplink transmission only after uplink synchronization with the system via a random access process.” (Ex. 1001, 1:22-25.)

30. It was well known to a person of ordinary skill that a UE performs a random access procedure by transmitting a random access *preamble* to the eNB before receiving a random access response (RAR) from the eNB. For example, as explained by Kim (Ex. 1011, ¶[0072].)

A random access procedure that a UE performs with a specific eNB may include (1) the UE transmitting a random access preamble to the eNB (hereafter, referred to as transmission of “a first message (message 1) if there is no confusion), (2) receiving a random access response from the eNB in response to the transmitted random access preamble (hereafter, referred to as reception of “a second message (message 2)” if there is no confusion), (3) transmitting a UL message using the information received

through the random access response message (hereafter, referred to as transmission of "a third message (message 3)" if there is no confusion) and (4) receiving a message corresponding to the UL message from the eNB (hereafter, referred to as reception of "a fourth message (message 4)" if there is no confusion).

31. Similarly, Lee describes at least 4 steps in a random access process between the terminal (UE) and the eNB (BS). (Ex. 1007, 14:34-46.)

VI. THE '430 PATENT

32. The '430 patent relates to wireless communication technology and a method for requesting radio resource by a user equipment ("UE") from a base station ("eNB") over a time-frequency resource. (Ex. 1001, Abstract.) The '430 patent purports to claim a method of random access where the UE requests access to radio resources (i.e., a radio channel) from the eNB by sending a random access preamble message (msg. 1); the eNB responds to the random access preamble message by sending back a random access response (RAR) message to the UE (msg. 2); the RAR message is received by the UE and may also be received by other UE(s) that are part of the same UE group as the UE sending the preamble; UE then responds to the RAR by sending a message identifying itself with a unique ID for resolving contention in the event the RAR is received by multiple UEs (msg. 3); eNB then sends a back a confirmation message (msg. 4) . (Ex. 1001, 11:40-12:20.) *See also id.*, FIGs. 1-2.

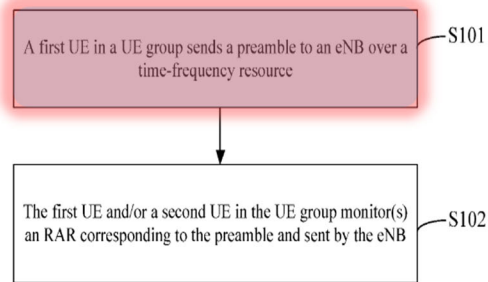


FIG. 1

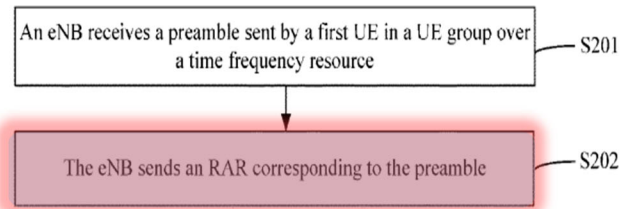


FIG. 2

33. As explained in more detail in Section IX below, the challenged claims broadly cover a previously known method for requesting channel access using the random access procedure. (*See* Section IX.)

VII. OVERVIEW OF THE PRIOR ART

A. Li

34. Li is directed “to a method and system for accessing a network.” (Ex. 1005, ¶[0002].) In particular, “FIG. 6 is a schematic flowchart of a network access method according to another embodiment of the invention, showing contention based random access.” (*Id.*, ¶[0106].) Li discloses a step 601, in which a particular UE known as “MTC UE1 may send a random access preamble to an eNodeB.” (*Id.*, ¶[0119].) MTC UE1 is part of “a group, such as MTC UE1, MTC UE2, MTC UEn, MTC UEm, where n and m are positive integers larger than or equal to 2.” (*Id.*, ¶[0117].) After the MTC UE1 sends the preamble to the eNodeB in step 601, a

random access response (RAR) is transmitted as reply by the eNodeB and can be received by the MTC UE1. (*Id.*, ¶¶ [0120]-[0122].²)

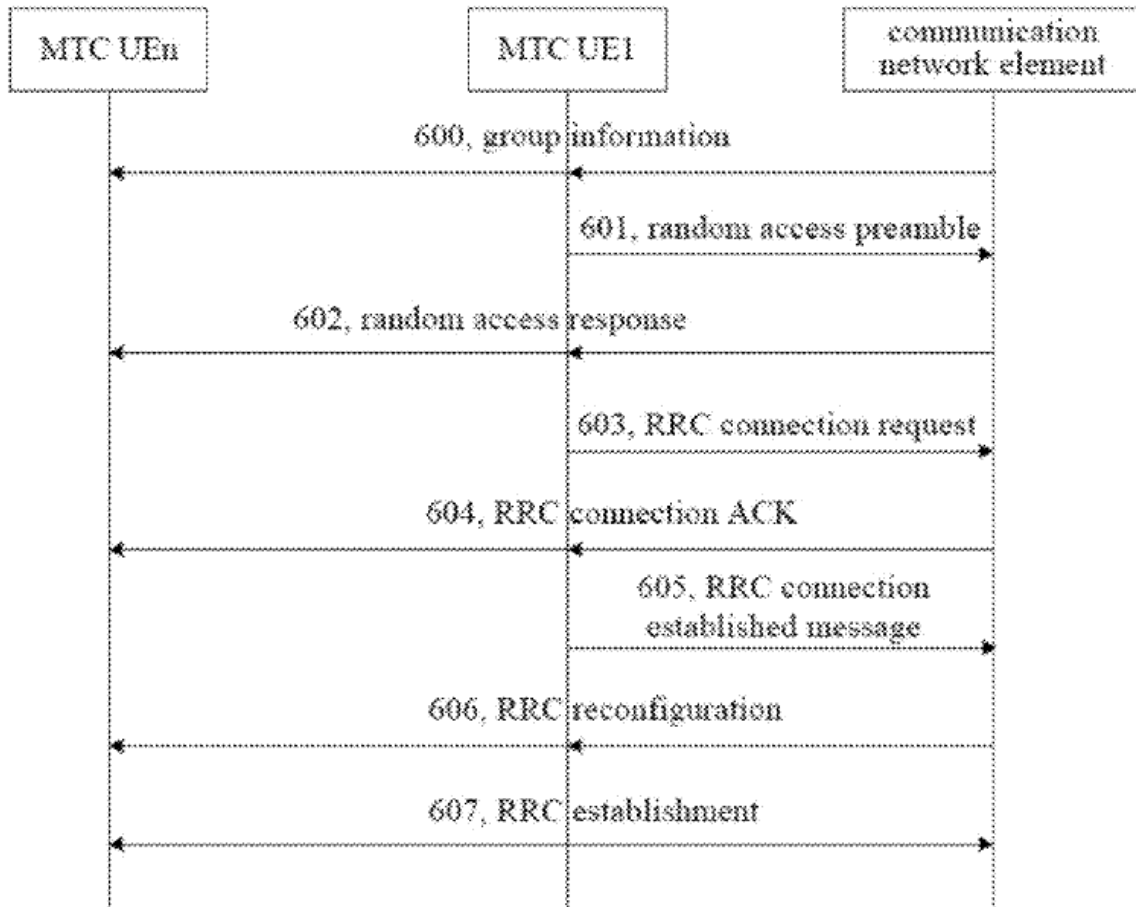


FIG. 6

² The RAR is sent by a “communication network element” (Ex. 1005, ¶[0120]) but that simply refers to the eNodeB (*id.*, ¶[0108].)

(*Id.*, FIG. 6.)

35. In step 603, “MTC UE1 may send a RRC connection request according to the T-CRNTI and RRC connection UL resources allocated by the communication network element.” (*Id.*, ¶[0126]; *see also id.*, ¶[0129].) The RRC connection request includes “the terminal ID of MTC UE1.” (*Id.*, ¶[0128].) As noted earlier in Li, “terminal ID may be IMSI, MSISDN, IP address, IMPU, IMPI and any other symbol used to uniquely identify a terminal.” (*Id.*, ¶[0066].) In step 604, “the communication network element returns an ACK to MTC UE1, for example, a RRC Connection ACK. The ACK may comprise the terminal ID of MTC UE1 or the group ID of the group MTC UE1 belongs to or the synchronized random number.” (*Id.*, ¶[0131].)

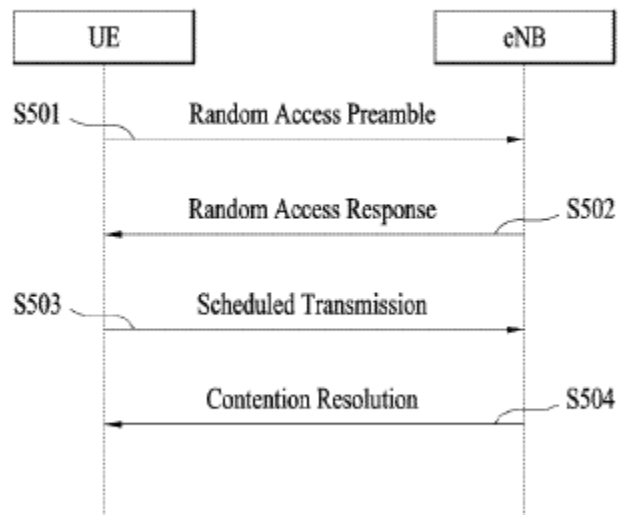
B. Kim

36. Kim discloses a method for performing a random access. (Ex. 1011, [0083] (“FIG. 5 is a diagram illustrating operations of the UE and the eNB performed in the condition[*sic*]-based random access procedure.”).³) Kim discloses that the UE transmits a random access preamble to the eNodeB over a PRACH resource in step

³ A person of ordinary skill would have understood that this is a typographical error and Kim meant “contention” as opposed to “condition.”

501. (*Id.*, ¶¶[0084]-[0085].) A PRACH refers “to a set of time-frequency resources.” (*Id.*, ¶[0054].)

FIG. 5



(*Id.*, FIG. 5.) Kim discloses that “after transmitting the random access preamble as performed in step S401, the UE attempts to receive a random access response thereof within a random access response reception window Thereby, the UE may receive a UL grant, a temporary C-RNTI and a TAC.” (*Id.*, ¶[0087], FIG. 5.⁴) Kim discloses that “[i]f the UE receives a valid random access response, the UE processes

⁴ “S401” is a typographical error; instead, Kim intended to recite “S501” as evident from Figure 5.

the information included in the random access response. That is, the UE applies the TAC and stores the temporary C-RNTI. In addition, the UE transmits data (i.e., message 3) to the eNB using the UL grant (S403).” (*Id.*, ¶¶[0089].⁵) Kim discloses that “Message 3 should include an ID of the UE. This is because the eNB cannot determine which UEs perform the random access procedure in the contention-based random access procedure and the UEs need to be identified for future contention resolution.” (*Id.*) The UE ID may be a “unique ID (e.g., System Architecture Evolution (SAE)-Temporary Mobile Subscriber Identity (S-TMSI) or a random ID).” (*Id.*, ¶[0090].)

VIII. CLAIM CONSTRUCTION

37. I have been informed by counsel and understand that when considering the meaning of patent claims, one must consider the language of the claims, the specification, and the prosecution history of the patent. I also understand that claim terms are typically given their ordinary and customary meanings as would have been understood by a person of ordinary skill in the art (POSITA) at the time of the invention for the patent. For purposes of my opinions in this declaration, I have applied the plain and ordinary meaning as understood by a POSITA at the time of

⁵ Again, “S403” is a typographical error; instead, Kim intended to recite “S503” as evident from Figure 5.

the alleged invention, and I have applied such understandings in my analysis of the '430 patent and the prior art.

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL RECITED FEATURES OF THE CHALLENGED CLAIMS

38. In my opinion, the prior art discussed below discloses and/or suggests the limitations of claims 1-15, 17, and 18.

A. Li Discloses and/or Suggests the Limitations of Claims 1-3, 7, 11, 13, 14, 15, and 18

1. Claim 1

i) [1.pre] “A random access method, comprising:”

39. Li discloses the limitations therein. Li is directed “to a method and system for accessing a network.” (Ex. 1005, ¶[0002].) In particular, “FIG. 6 is a schematic flowchart of a network access method according to another embodiment of the invention, showing contention based *random access*.” (*Id.*, ¶[0106] (emphasis added).)

ii) [1.a] “sending, by a first User Equipment (UE) in a UE group, a preamble to an evolved Node B (eNB) over a time frequency resource;”

40. Li discloses or suggests this limitation. For example, Li discloses a step 601, in which an “MTC UE1 may send a random access preamble to an eNodeB.” (Ex. 1005, ¶[0119].) MTC UE1 is part of “a group, such as MTC UE1, MTC UE2,

MTC UEn, MTC UEm, where n and m are positive integers larger than or equal to 2.” (*Id.*, ¶[0117].)

41. Li discloses that the preamble is sent over a time and frequency resource. Specifically, Li discloses that Figure 6 is described by taking the “LTE system as an example” and is a “contention based random access.” (Ex. 1005, ¶¶[0107], [0109].) Li discloses that, in LTE, “random access resources comprise two parts: slot and frequency for initiating a random access; and preamble to be used.” (*Id.*, ¶[0009].) It would have been well known to a person of ordinary skill in the art that in LTE, a slot denotes a time domain unit of resource for transmission and reception, and the “slot and frequency” represent a time-frequency resource. And in “contention based random access,” the “UE may randomly select a random access frequency resource at a next time that allows random access, and then initiate a random access at the selected time-frequency position.” (*Id.*, ¶[0011].) Thus, Li discloses that the MTC UE1 sends the preamble to the eNodeB over a “random access frequency resource at a next time” slot (i.e., the claimed “time frequency resource”).

iii) [1.b] “the time-frequency resource comprising a time domain resource and a frequency domain resource;”

42. Li discloses this limitation. As discussed above, Li discloses that the MTC UE1 sends the preamble to the eNodeB over a time-frequency resource, i.e.,

over a “random access frequency resource” (claimed “frequency domain resource”) “at a next time” slot (claimed “time domain resource”). Specifically, Li discloses that, in LTE, “random access resources comprise two parts: slot and frequency for initiating a random access; and preamble to be used.” (*Id.*, ¶[0009].) As discussed with respect to [1.b], it would have been well known to a person of ordinary skill in the art that in LTE, a slot denotes a time domain unit of resource (claimed “time domain resource”). Li discloses limitation [1.c] by disclosing random access resources comprising slot (a time domain resource) and frequency (a frequency domain resource) for initiating a random access.

iv) [1.c] “monitoring, by at least one of the first UE or a second UE in the UE group, a Random Access Response (RAR) corresponding to the preamble and sent by the eNB”

43. Li discloses this limitation. After the MTC UE1 sends the preamble to the eNodeB in step 601, a random access response (RAR) is sent by the eNodeB to the MTC UE1. (Ex. 1005, ¶¶ [0120]-[0122].⁶) “Because all terminals in the group have the same random number, *all of other terminals* in the group except the first terminal can monitor the RAR to the first terminal. For example, MTC UEn monitors

⁶ The RAR is sent by a “communication network element” (Ex. 1005, ¶[0120]) but that simply refers to the eNodeB (*id.*, ¶[0108]).

the RAR to the first terminal according to the RA-RNTI and the preamble ID.” (*Id.* (emphasis added)). The “first terminal” referenced in the previous sentence is MTC UE1. (*Id.*, ¶[0117].) Thus, Li discloses that “at least . . . a second UE in the UE group” monitors the RAR, sent by the eNB, corresponding to the preamble. Here, MTC UE1 is a “first UE,” which is part of a UE group and the MTC UEn constitute a “second UE.”

- v) **[1.d] “wherein the first UE is at least one UE in the UE group, and the second UE is all or some UEs in the UE group;”**

44. Li discloses this limitation. As discussed above, MTC UE1 is part of “a group, such as MTC UE1, MTC UE2, MTC UEn, MTC UEm, where n and m are positive integers larger than or equal to 2.” (Ex. 1005, ¶[0117].) Moreover, the RAR is monitored by “MTC UEn” (*id.*, ¶[0122]), which refers “other terminals except the first terminal [MTC UE1]” (*id.*, ¶[0117].)

- vi) **[1.e] “after monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB, sending, by at least one of the first UE or the second UE, a message 3 according to a Uplink (UL) grant allocated thereto”**

45. Li discloses this limitation.⁷ In step 603, “MTC UE1 may send a RRC connection request according to the T-CRNTI and RRC connection *UL resources* allocated by the communication network element.” (Ex. 1005, ¶[0126] (emphasis added); *see also id.*, ¶[0129].) The “UL resources” constitute an “Uplink (UL grant) allocated” to the MTC UE1. The RRC connection request is a “message 3” (or Msg3) because it takes place after the random access preamble sent by the MTC UE1 in step 601 and reception (monitoring) of the random access response (RAR) sent by the eNB in step 602.

- vii) **[1.f] “wherein the message 3 comprises a number of UEs having random access requests in the UE group or a number of UEs contained in the UE group or a pre-set UE number.”**

46. Li discloses this limitation.⁸ In particular, the RRC connection request includes “the terminal ID of MTC UE1.” (Ex. 1005, ¶[0128].) As noted earlier in

⁷ Claim limitation [1.e] requires “sending, by at least one of the first UE **OR** a second UE.” (Ex. 1001, claim 1 (emphasis added).) Therefore, the prior art reference need only disclose sending by one of the UEs to anticipate claim limitation [1.e].

⁸ Claim limitation [1.f] requires “a number of UEs having random access requests in the UE group **OR** a number of UEs contained in the UE group **OR** a pre-set UE

Li, “terminal ID may be IMSI, MSISDN, IP address, IMPU, IMPI and any other symbol used to uniquely identify a terminal.” (*Id.*, ¶[0066].) It would have been well known to a POSITA that these examples of terminal ID comprise pre-set numbers corresponding to the terminal (i.e., UE). Thus, the message 3 disclosed in Li includes a “pre-set UE number.”

2. Claim 2: “The method according to claim 1, wherein the first UE is at least one of the following: at least one fixed UE; or, at least one UE determined according to a pre-set rule; or, at least one UE notified by the eNB.”

47. Li discloses this claim.⁹ Among the terminals in a group, a particular terminal is selected as MTC UE1 “according to a predetermined setting.” (Ex. 1005, ¶[0117].) Thus Li discloses that the first UE is a UE “determined according to a pre-set rule.”

3. Claim 3: “The method according to claim 1, wherein at least one of the preamble, the time domain resource or the

number.” (Ex. 1001, claim 1 (emphasis added).) Therefore, the prior art reference need only disclose a pre-set UE number in message 3.

⁹ Claim 2 requires “at least one fixed UE; **OR**, at least one UE determined according to a pre-set rule; **OR**, at least one UE notified by the eNB.” (Ex. 1001, claim 2 (emphasis added).) Therefore, the prior art reference need only disclose one of the conditions.

frequency domain resource is pre-set, or determined by a group Identifier (ID) of the UE group, or notified by the eNB.”

48. Li discloses this claim.¹⁰ For example, Li discloses that in LTE contention based random access, the “eNB may broadcast information about access resources by which random access may be initiated in a cell, and then UE may randomly select an allowed preamble.” (Ex. 1005, ¶[0011].) Li further discloses that, in LTE, “random access resources comprise two parts: slot and frequency for initiating a random access; and preamble to be used.” (*Id.*, ¶[0009].) Therefore, Li discloses that the eNB may broadcast (notify) random access resources in terms of slot and frequency, and the preamble. Given that Figure 6 of Li is an example of LTE contention based random access (*id.*, ¶¶ [0107], [0109]), this disclosure applies to Figure 6. Thus, Li discloses that the preamble sent by MTC UE1 in step 601 is one that is “notified by the eNB.”

¹⁰ Claim 3 requires “one of the preamble, the time domain resource **OR** the frequency domain resource is pre-set, **OR** determined by a group Identifier (ID) of the UE group, **OR** notified by the eNB.” (Ex. 1001, claim 3 (emphasis added).) Therefore, the prior art reference need only disclose that the UE is notified by the eNB.

4. **Claim 7: “The method according to claim 1, further comprising: after sending, by at least one of the first UE or the second UE, the message 3 according to the UL grant allocated thereto, receiving, by at least one of the first UE or the second UE, a message 4 sent by the eNB.”**

49. Li discloses this claim.¹¹ In step 604, “the communication network element returns an ACK to MTC UE1, for example, a RRC Connection ACK. The ACK may comprise the terminal ID of MTC UE1 or the group ID of the group MTC UE1 belongs to or the synchronized random number.” (Ex. 1005, ¶[0131].) This RRC Connection ACK is a “message 4” sent by the eNB (communication network element).

¹¹ Claim 7 requires “receiving, by at least one of the first UE **OR** the second UE, a message 4 sent by the eNB.” (Ex. 1001, claim 7 (emphasis added).) Therefore, the prior art reference need only disclose receiving, by the first UE, a message 4 sent by the eNB to anticipate claim 7.

5. **Claim 11: “The method according to claim 7, further comprising: after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, sending, by at least one of the first UE or the second UE, an indicating signal for notifying the eNB of a successful access of at least one of the first UE or the second UE to the eNB, wherein the indicating signal is a Scheduling Request (SR) or an Acknowledgement (ACK) signal.”**

50. Li discloses this claim.¹² Once the RRC connection ACK is received in step 604, the MTC UE 1 sends an “RRC connection established message” to the

¹² Claim 11 requires “after receiving, by at least one of the first UE **OR** the second UE, the message 4 sent by the eNB, sending, by at least one of the first UE **OR** the second UE, an indicating signal for notifying the eNB of a successful access of at least one of the first UE **OR** the second UE to the eNB, wherein the indicating signal is a Scheduling Request (SR) **OR** an Acknowledgement (ACK) signal.” (Ex. 1001, claim 11 (emphasis added).) Therefore, the prior art reference need only teach after receiving, by the first UE, the message 4 sent by the eNB, sending, by the second UE, an indicating signal for notifying the eNB of a successful access of the first UE to the eNB, wherein the indicating signal is a Scheduling Request (SR) to teach Claim 11. Alternatively, the prior art reference need only teach after receiving, by the first UE, the message 4 sent by the eNB, sending, by the second UE, an indicating

eNodeB in steps 605-606. (Ex. 1005, ¶[0133], [0134].) The “RRC connection established message” is an “Acknowledgement (ACK) signal” as it indicates the successful establishment of an RRC connection, “[o]nce the RRC connection ACK is received in step 604”.

6. Claim 13: “The method according to claim 7, wherein the message 3 and the message 4 comprise a group ID of the UE group or a preset field.”

51. Li discloses this claim.¹³ As discussed above, the RRC connection request (message 3) sent in step 603 includes the terminal ID (“preset field”) of MTC UE 1. (*Supra* Section IX.A.1.vii.) Furthermore, in step 604, “the communication network element returns an ACK to MTC UE1, for example, a RRC Connection ACK. The ACK may comprise the *terminal ID* of MTC UE1 or the *group ID* of the group MTC UE1 belongs to or the synchronized random number.” (Ex. 1005,

signal for notifying the eNB of a successful access of the second UE to the eNB, wherein the indicating signal is a Scheduling Request (SR) to teach Claim 11.

¹³ Claim 13 requires that “the message 3 and the message 4 comprise a group ID of the UE group **OR** a preset field.” (Ex. 1001, claim 13 (emphasis added).) Therefore, the prior art reference need only disclose that the message 3 and the message 4 comprise a preset field to anticipate claim 13.

¶[0131] (emphasis added).) The ACK is message 4. Kim further discloses that the data of message “contains the unique ID of the UE.” (Ex. 1011, ¶[0092].)

7. **Claim 14: “The method according to claim 1, further comprising: before sending, by the first UE in the UE group, the preamble over the time-frequency resource, receiving, by at least one of the first UE or the second UE, Downlink Control Information (DCI) or a paging message or a Radio Resource Control (RRC) message sent by the eNB; or, receiving, by the first UE, random access request information sent by the second UE.”**

52. Li discloses claim 14. Li discloses a step 601, in which an “MTC UE1 may send a random access preamble to an eNodeB.” (Ex. 1005, ¶[0119].) But prior to MTC UE1 sending a random access preamble in step 601, the MTC UE1 receives a group ID from the eNodeB in step 600. (Ex. 1005, ¶¶[0106]-[0112], FIG. 6.) Specifically, in *step 600*, “[a]fter dividing terminals into one or more groups, the communication network element broadcasts group information including terminals IDs of all terminals in each group, so that each terminal can calculate a group ID of the group it belongs to according to terminal IDs of all terminals in the group.” (*Id.*, ¶[0111].) And “[i]n another embodiment,” the communication network element “broadcasts group information including group IDs of the groups or including group

IDs of the groups and terminal IDs of all terminals in each group.” (*Id.*, ¶[0112].¹⁴)

The MTC UE1 includes this group ID or the terminal ID in message 3 (RRC connection request) sent in step 603. (*Id.*, ¶[0125]-[0128].)

53. Thus, Li discloses that the terminals in the group (which includes MTC UE1) receive a terminal ID or a group ID from the eNodeB in step 600 before MTC UE1 sends the preamble in step 601. The message containing “group ID” and the “terminal ID” constitutes Downlink Control Information (DCI) as confirmed by claim 15 of the ’430 patent, which recites that the DCI includes a group ID. (Ex. 1001, claim 15.) Furthermore, the group information is “broadcast” in step 600. (Ex. 1005, ¶[0112].) Such broadcast information constitutes a “paging” message to “all terminals in a group” (Ex. 1005, ¶[0112]), which claim 15 further confirms by noting that a “paging” message includes group ID.

- 8. Claim 15: “The method according to claim 14, wherein receiving, by at least one of the first UE or the second UE, the DCI or the paging message or the RRC message sent by the eNB comprises at least one of the following:**

the DCI or a CRC of DCI for scheduling the paging message or the RRC message is scrambled by using a group ID or the UE group;

¹⁴ The “communication network element” refers to the eNodeB. (Ex. 1005, ¶[0108].)

the DCI or the paging message or the RRC message comprises a group ID of the UE group;

the DCI or the paging message or the RRC message comprises an ID of at least one of the first UE or the second UE; or

the DCI or the paging message or the RRC message comprises at least one of an ID of the preamble, the time domain resource of the preamble or the frequency domain resource of the preamble.”

54. Li discloses claim 15.¹⁵ As discussed above, Li that the terminals in the group (which includes MTC UE1) receive a group ID or a terminal ID from the eNodeB in step 600 before MTC UE1 send the preamble in step 601. (*Supra* Section IX.A.7, analysis for claim 14.) Thus, Li discloses that “the DCI or the paging message or the RRC message comprises a group ID of the UE group” and “the DCI or the paging message or the RRC message comprises an ID of at least one of the first UE or the second UE.”

9. Claim 18

i) [18.pre] “A User Equipment (UE), comprising:”

55. Li discloses the limitations therein. “FIG. 8 is a schematic structure diagram of a terminal 800 according to another embodiment of the invention. The

¹⁵ Claim 15 lists four alternatives and only one alternative needs to be disclosed by the prior art.

terminal 800 may be a mobile terminal or a fixed terminal or a MTC terminal.” (Ex. 1005, ¶[0159].) “FIG. 9 is another schematic structure diagram of the terminal 800 according to another embodiment of the invention.” (*Id.*, ¶[0164].)

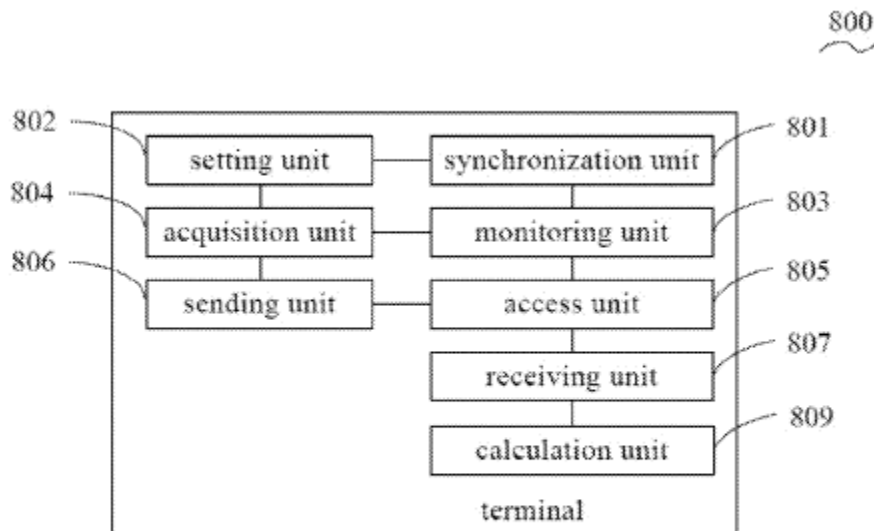


FIG. 9

(*Id.*, FIG. 9.)

ii) [18.a] “a sending unit, and a monitoring unit,”¹⁶

¹⁶ For the terms “sending unit” and “monitoring unit,” there is no corresponding structure (e.g., an algorithm) disclosed in the ’430 patent. For example, the ’430 patent merely notes that each “function unit . . . may be implemented by using a general computation apparatus.” (Ex. 1001, 29:44-46.)

56. Li discloses this limitation. Li discloses “if the terminal 800 is the first terminal, it may further comprise a sending unit 806 for sending a preamble to the network.” (Ex. 1005, ¶[0176].) Further, “the monitoring unit 803 is configured to monitor the RAR to the first terminal according to the RA-RNTI and the preamble ID.” (*Id.*, 0175].)

- iii) **[18.b] “wherein the sending unit is configured to : send a preamble to an evolved Node B (eNB) over a time-frequency resource , the time-frequency resource comprising a time domain resource and a frequency domain resource,”**

57. Li discloses this limitation. Li discloses “if the terminal 800 is the first terminal, it may further comprise a sending unit 806 for sending a preamble to the network.” (Ex. 1005, ¶[0176].) And Li discloses with reference to Figure 6 how the first terminal (MTC UE1) transmits a preamble to the eNB over a time and frequency resource. (*Supra* Section IX.A.1.ii-iii (analysis for limitations [1.a] and [1.b]).¹⁷)

- iv) **[18.c] “the monitoring unit is configured to : monitor a Random Access Response (RAR) corresponding to the preamble and sent by the eNB ;”**

¹⁷ A POSITA would have understood that the discussion of Figure 6 applies to the details regarding a terminal as set forth in Figures 8 and 9. In other words, the terminal or UE discussed with respect to Figure 6 is further described with reference to Figures 8 and 9.

58. Li discloses this limitation. Li discloses that “the monitoring unit 803 is configured to monitor the RAR to the first terminal according to the RA-RNTI and the preamble ID.” (Ex. 1005, 0175[.]) This is described in further detail with reference to Figure 6, which explains how the other terminals in the group monitor the random access response, sent by the eNB, corresponding to the preamble sent by MTC UE1. (*Supra* Section IX.A.1.iv (analysis for limitation [1.c]).)

- v) **[18.d] “the sending unit is further configured to : send a message 3 according to a Uplink (UL) grant allocated to the UE,”**

59. Li discloses this limitation. Li discloses that “[a]fter the RAR sent from the network is received by the receiving unit 807, the sending unit 806 is further used to send RRC connection request . . . on the allocated RRC connection UL resources, where the RRC connection request . . . carries the terminal ID of the first terminal or the group ID of the group the first terminal belongs to or the synchronized random number.” (Ex. 1005, ¶[0177].) This is described in further detail with reference to Figure 6, which explains the sending of a message 3 (RRC connection request) by the MTC UE1. (*Supra* Section IX.A.1.vi (analysis for limitation [1.e]).)

- vi) **[18.e] “wherein the message 3 comprises a number of UEs having random access requests in a UE group or a number of UEs contained in the UE group or a pre-set UE number.”**

60. Li discloses this limitation. Li discloses that “[a]fter the RAR sent from the network is received by the receiving unit 807, the sending unit 806 is further used to send RRC connection request . . . on the allocated RRC connection UL resources, where *the RRC connection request . . . carries the terminal ID of the first terminal* or the group ID of the group the first terminal belongs to or the synchronized random number.” (Ex. 1005, ¶[0177] (emphasis added).) This is described in further detail with reference to Figure 6, which explains the sending of a message 3 (RRC connection request) by the MTC UE1 includes the “terminal ID” of MTC UE1 and that is a “pre-set UE number.” (*Supra* Section IX.A.1.vii (analysis for limitation [1.f])).)

B. Li and Lee Disclose and/or Suggest the Limitations of Claims 5, 6, and 8-10

1. Claim 5: “The method according to claim 1, wherein”¹⁸

Li in view of Lee discloses or suggests this limitation.

i) [5.a] “monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB comprises:

(a) “descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a pre-set Random Access Radio

¹⁸ Claim 5 recites two alternatives separated by “or.” I group these alternatives as claim limitation [5a] and [5b]. The prior art need only disclose [5a] or [5b].

Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble, and receiving the RAR, the RAR comprising at least one of at least one Temporary Cell Radio Network Temporary Identity (TC-RNTI) or at least one Uplink (UL) grant; and”

61. As discussed above with respect to claim limitation [1.c], Li discloses that all terminals except the first terminal “can monitor the RAR to the first terminal.” (Ex. 1005, ¶[0122].) “The RAR may comprise at least one of TA (Timing Advance), T-CRNTI, next stage UL resource allocation (UL GRANT), and a preamble ID.” (*Id.*, ¶[0121].) Therefore, Li discloses “receiving the RAR, the RAR comprising at least one of at least one Temporary Cell Radio Network Temporary Identity (TC-RNTI) or at least one Uplink (UL) grant,” as claimed.

62. To the extent Li is found to not expressly disclose “descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a pre-set Random Access Radio Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble” as recited in claim [5.a], Lee discloses such a feature. Lee discloses a contention based random access procedure between a UE and an eNB. (Ex. 1007, 10:26-41, 14:30-53, 18:32-23:23.) Lee further discloses the individual transmissions of the general random access procedure, which include sending a random access preamble, receiving a random access response, a message 3, and a message 4. (*Id.*, 14:34-53, 18:32-23:23.) Moreover, Lee discloses that

during such a procedure, the UE uses UE identifiers (RNTIs) such as the RA-RNTI and the TC-RNTI. (*Id.*, 12:47-62, 18:53-20:45, 21:5-22:15.) Given that both Li and Lee disclose random access procedure between a UE and an eNodeB, a person having ordinary skill in the art would have reason to look to Lee to improve upon the teachings of Li.

63. Lee discloses a contention-based random access procedure with reference to Figure 9. (Ex. 1007, 18:32-34.) Just like Li, message 2 in Lee's random-access procedure is the random access response (RAR). (*Id.*, 19:1-10.) The RAR is delivered to the UE "through a PDSCH" (physical data shared channel). (*Id.*, 19:24-26.). To receive the RAR, the UE first detects a physical downlink control channel (PDCCH) "*masked with RA-RNTI*" and then "receives the PDSCH that is indicated by the detected PDCCH." (Ex. 1007, 19:18-33 (emphasis added).¹⁹) The PDCCH comprises downlink control information (DCI). (*Id.*, 12:37-39, ("Control information transmitted over the PDCCH is referred to as downlink control information (DCI).") Lee discloses that the PDCCH includes CRC bits "masked" (i.e., scrambled) with the UE's RA-RNTI. (*Id.*, 12:47-62, ("A BS

¹⁹ In the context of the '430 patent, masking and scrambling refer to the same operation. For example, the '430 patent refers to "masking or scrambling." (Ex. 1001, 13:58-60, 15:11.)

determines a PDCCH format according to DCI to be transmitted to a UE, and attaches a cyclic redundancy check (CRC) to control information. The CRC is masked with a unique identifier (referred to as a radio network temporary identifier (RNTI) according to an owner or usage of the PDCCH. ... To indicate a random access response that is a response for transmission of a random access preamble of the UE, a random access-RNTI (RA-RNTI) may be masked to the CRC.”.) Thus, a person of ordinary skill would have known that, when receiving the PDCCH, the UE *descrambles* the CRC of the DCI because the CRC is masked (i.e., scrambled), in order to confirm the correct reception of the PDCCH associated with the UE’s RA-RNTI. This is what Lee means by the “UE . . . detects the PDCCH masked with RA-RNTI.” (*Id.*, 19:18-24.)

64. In view of the above, Lee discloses the following: the PDCCH has CRC that is scrambled; the UE descrambles the CRC of the PDCCH using the RA-RNTI associated with the UE’s transmitted preamble; the PDCCH comprises DCI and indicates the PDSCH, which includes the RAR. Therefore, Lee discloses “descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a . . . Random Access Radio Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble. . . ,” as claimed. The PDCCH is “for scheduling the RAR” because the “PDSCH . . . is indicated by the detected

PDCCH” and the RAR is received via the PDSCH. (*Id.*, 19:18-33.) Furthermore, the RA-RNTI corresponds to the preamble, as claimed because the base station (i.e., eNodeB) “decodes the preamble and obtains an RA-RNTI.” (*Id.*, 18:53-67.)

65. Having looked at Lee, a person having ordinary skill in the art would have been motivated to combine Li’s teachings with those of Lee to enable Li’s UE to receive the random access response designated for it. Lee’s teachings concern the same random access process (including message 1, message 2, and message 3) as described by Li. Lee provides additional disclosure relating to the transmission of the random access response (message 2) in Li. As described above, Lee teaches that a random access response is delivered via a PDSCH, which is indicated by a PDCCH received/detected by the UE. Importantly, a PDCCH has associated CRC bits that are scrambled using an identifier unique to the UE to which that PDCCH is directed. This enables the correct UE to receive the PDCCH intended for it because only that UE correctly descrambles the CRC bits of the PDCCH. In my opinion, combining the teachings of Lee with Li would have been apparent because it would have constituted applying a known feature (Lee’s techniques) to a particular device (the Li eNB and UEs) to achieve a predictable result (enabling reception of a random access response by the UE to which the response is directed).

66. A person having ordinary skill in the art would have had a reasonable expectation of success implementing such a combination. For example, a person

having ordinary skill in the art would have known how to implement scrambling and descrambling of DCI, and would have further known how PDDCH and PUSCH operated in the context of random access. Utilizing Lee's techniques with Li would have been well within the skills of a person having ordinary skill in the art, because, for example, a person having ordinary skill in the art would have merely needed to program a transceiver processor to configure Li's eNodeB and UEs to utilize Lee's above-noted techniques.

67. Thus, Li in combination with Lee discloses or suggests the limitation.

(b) “determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR; or”

68. Li discloses that the MTC UE1 utilizes the TC-RNTI and the UL grant resources allocated to it by the eNodeB in the RAR. (Ex. 1005, ¶¶[0125]-[0129].) Thus, Li discloses that the MTC UE1 determines the TC-RNTI and the UL grant from the information in the RAR.

ii) [5.b] “monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB comprises: determining, by at least one of the first UE or the second UE, corresponding RA-RNTIs according to at least one of respective IDs or preambles, descrambling a CRC of DCI for scheduling the RAR according to the corresponding RA-RNTIs, and receiving corresponding RARs, the RAR comprising at least one of a TC-RNTI or a UL grant allocated to

the first UE or second UE.”

69. This is an optional feature and need not be disclosed because [5.a] is disclosed.

2. **Claim 6: “The method according to claim 5, wherein determining, by at least one of the first UE or the second UE, at least one of the TC-RNTI or the UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR comprises: determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or a UL grant allocated thereto according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule.”**

70. Li in combination with Lee discloses or suggests this claim.²⁰ Li discloses that the MTC UE1 utilizes the TC-RNTI and the UL grant resources allocated to it by the eNodeB in the RAR. (Ex. 1005, ¶¶[0125]-[0129].) To a POSITA, such a determining step by at least one of the first UE or the second UE also uses a pre-set rule to receive and decode the information within the RAR

²⁰ Claim 6 requires “determining, by at least one of the first UE **OR** the second UE, at least one of a TC-RNTI **OR** a UL grant allocated thereto according to at least one of an ID of the first UE **OR** the second UE in accordance with a pre-set rule.” (Ex. 1001, claim 6 (emphasis added).) Therefore, the prior art reference need only teach determining, by the first UE, a UL grant allocated thereto according to an ID of the first UE in accordance with a pre-set rule to teach Claim 6.

according to at least one of an ID of the first UE or the second UE. Thus, Li discloses that the MTC UE1 determines the TC-RNTI and the UL grant from the information in the RAR. To the extent Li is not found to expressly disclose that this TC-RNTI and UL grant are determined “according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule,” as claimed, the Li-Lee combination discloses such a feature.

71. For example, in the Li-Lee combination discussed above with respect to claim 5 in Section IX.B.1, the UE detects the PDCCH to receive the RAR, and more specifically, the “UE . . . detects the PDCCH masked with RA-RNTI.” (Ex. 1007, 19:18-24.) The RA-RNTI is a network “ID” of the UE, as disclosed in Lee. Lee discloses that “RNTI is a unique identity given to a terminal and a value thereof may be determined according to a position in which the corresponding RNTI is generated. The RNTI includes C-RNTI (cell RNTI), M-RNTI (MBMS (multimedia broadcast multicast service) RNTI), P-RNTI (paging RNTI), RA - RNTI (random access RNTI), SI - RNTI (system information RNTI), TPC-PUCCH-RNTI (transmit power control PUCCH - RNTI), and TPC-PUSCH-RNTI (transmit power control PUSCH RNTI).” (*Id.*, 19:33-42.) Therefore, the RAR (and its contents including the TC-RNTI and the UL grant) are determined “according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule,” as claimed. The fact that the PDCCH is masked with the RA-RNTI is a “pre-set rule.” Therefore, a

POSITA would have understood that the corresponding decoding and reception of the PDCCH masked with the RA-RNTI by at least one of the first UE or the second UE would also follow the same “pre-set rule.”

3. **Claim 8: “The method according to claim 7, wherein receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB comprises: scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE.”**

72. Li in view of Lee discloses or suggests this claim.²¹ As discussed above with respect to claim 7, Li discloses that in step 604, “the communication network element returns an ACK to MTC UE1, for example, a RRC Connection ACK. The ACK may comprise the terminal ID of MTC UE1 or the group ID of the group MTC UE1 belongs to or the synchronized random number.” (Ex. 1005, ¶[0131].) This RRC Connection ACK is a “message 4” sent by the eNB (communication network element). To the extent it is argued that Li does not expressly disclose “scrambling

²¹ Claim 8 requires “scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE **OR** the second UE.” (Ex. 1001, claim 8 (emphasis added).) Therefore, the prior art reference need only teach scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to the first UE to teach Claim 8.

a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE” as recited in claim 8, Lee discloses such a feature. Specifically, Lee discloses that a message 4 pertaining to contention resolution is transmitted by the eNodeB to the UE after receiving message 3. (Ex. 1007, 21:47-22:15.) And transmission of message 4 involves the transmission of a PDCCH by the eNodeB, which the UE attempts to receive “using the TC-RNTI” of the UE. (*Id.*) As discussed above with respect to claim 5 in Section IX.B.1, a POSITA would have understood that one way of “using the TC-RNTI” by the eNodeB was scrambling the CRC bits of the PDCCH by using the “TC-RNTI,” and the UE would then use the same TC-RNTI to descramble the CRC bits and receive the PDCCH. A POSITA would have understood that, when receiving the message 4 sent by the eNB by at least one of the first UE or the second UE, the receiving UE would first receive and decode the DCI for scheduling the message 4. As discussed above in claim 5, Li in view of Lee discloses that one way of “using the TC-RNTI” by the eNodeB was scrambling the CRC bits of the PDCCH by using the “TC-RNTI”. A POSITA would have understood that a typical way of descrambling the CRC bits of the DCI that were already scrambled by the “TC-RNTI” was to scramble once again the received and scrambled CRC of the DCI. Thus, Li in view of Lee, discloses or suggests the step of scrambling a CRC of DCI for scheduling the

message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE, in order to achieve descrambling.

73. A person having ordinary skill in the art would have been motivated to combine Li with Lee's teachings of scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to the first UE, in view of Lee's similarity to Li. (Section IX.B.1.i, *supra* (explaining similarities between Li and Lee.)) Having looked at Lee, a person having ordinary skill in the art would have been motivated to enable Li's eNodeB to scramble a CRC of DCI for scheduling the message 4 according to the teachings of Lee. Specifically, by scrambling the CRC, the eNodeB can "resolve contention" with the "relevant UE" that has not been assigned a C-RNTI. (Ex. 1007, 21:48-22:15.) Thus, a person having ordinary skill in the art would have been motivated to enable Li's eNodeB to scramble to obtain the various advantages derived from such descrambling as more fully set forth in Lee. As explained above with respect to claim 5, adding CRC bits to a PDCCH and scrambling them allows the PDCCH to be received by the intended UE (in this case, MTC UE1) and a person having ordinary skill in the art would have been able to make the relevant changes to Li's system to implement such a modification.

74. Thus, Li in view of Lee discloses or suggests this claim.

4. **Claim 9: "The method according to claim 8, wherein the message 4 comprises at least one set of radio resources,**

radio resources allocated to at least one of the first UE or the second UE are determined by at least one of the first UE or the second UE according to at least one set of radio resources in the message 4; or the message 4 comprises a set of radio resources allocated to the first UE or second UE.”

75. Li in combination with Lee discloses or suggests this claim.²²

76. As discussed above with respect to claim 7, Li discloses that in step 604, “the communication network element returns an ACK to MTC UE1, for example, a RRC Connection ACK. The ACK may comprise the terminal ID of MTC UE1 or the group ID of the group MTC UE1 belongs to or the synchronized random number.” (Ex. 1005, ¶[0131].) This RRC Connection ACK is a “message 4” sent by the eNB (communication network element). After this message 4, an RRC connection established message is returned by the MTC UE1 to the eNB, and in

²² Claim 9 requires “the message 4 comprises at least one set of radio resources, radio resources allocated to at least one of the first UE **OR** the second UE are determined by at least one of the first UE **OR** the second UE according to at least one set of radio resources in the message 4; **OR** the message 4 comprises a set of radio resources allocated to the first UE **OR** second UE” (Ex. 1001, claim 9 (emphasis added).) Therefore, the prior art reference need only teach the message 4 comprises a set of radio resources allocated to the first UE to teach Claim 9.

response the eNB transmits an RRC connection reconfiguration message that allocates “resources,” such as “group based signaling radio bearers (SRB) and group based dedicated radio bearers (DRB)” to the “other terminals in the group except MTC UE1.” (Ex. 1005, ¶¶[0133], [0134], FIG. 6.) As noted above in Section IX.A.1.v (claim [1.d]), these other terminals constitute a “second UE” in the context of the claims. Thus, Li discloses “a set of radio resources allocated to the first UE or second UE.” To the extent it is argued that Li does not express this allocation of radio resources in “message 4,” as claimed, such a feature would have been known based on Lee.

77. Lee discloses an RRC connection setup message as a message 4. (Ex. 1007, 14:51-53 (“The RRC connection setup message may correspond to a fourth message (message 4) of the random access procedure.”).) “The RRC connection setup message includes configuration information for setting SRB1” and “by transmitting the RRC connection setup message to the terminal” (the UE), the “BS” (eNB) “allocates SRB (e.g., SRB 1) configuration resource to be dedicatedly used by the terminal.” (Ex. 1007, 14:63-67.) The SRB resources are just like those provided by the RRC reconfiguration message in Li.

78. A person having ordinary skill in the art would have been motivated to modify Li to include the set of radio resources transmitted in step 606 in Li’s

message 4 in step 604, which is message 4. Specifically, by assigning to Li's MTC UE1 the radio resources included in message 4, the UE can transition to an RRC connected state. (Ex. 1007, 15:24-30.) And the UE can do so without the need for another round of message exchange with the eNB which would have generated more messages within the network and contributed to network congestion. Such a change would have reduced the number of steps required for establishing an RRC connection between the UEs and the eNodeB, and would have reduced network congestion by way of reducing the number of messages transmitted on the network. Thus, a person having ordinary skill in the art would have been motivated to include resources in message 4 to obtain the various advantages derived from such allocation of radio resources in message 4 as more fully set forth in Lee. And a person having ordinary skill in the art would have been able to implement any such change with reasonable success because, for example, such a change would simply require modifying a message sequence, which can be accomplished by basic programming.

5. **Claim 10: "The method according to claim 9, wherein the radio resources allocated to at least one of the first UE or the second UE are further determined by at least one of the first UE or the second UE according to an ID of at least one of the first UE or the second UE in accordance with a pre-set rule."**

79. Li in combination with Lee discloses or suggests this claim.²³ For example, as discussed above with respect to claim 9, in the Li-Lee combination, the second UE (i.e., Li's UEs other than MTC UE1) receives radio resources (group based SRB and DRB) allocated thereto by the eNodeB. (*Supra* Section IX.B.4.) These other terminals "may initiate network access using the RRC connection UL resources allocated by the communication network element," (i.e., eNodeB). (Ex. 1005, ¶[0136].) Because other terminals (i.e., "second UE") use these RRC resources, the radio resources are necessarily determined by the second UE.

80. Furthermore, in the Li-Lee combination, the message 4 is deciphered by the UEs using a TC-RNTI of the UEs. (*Supra* Section IX.B.3.) Because message 4 includes the radio resources (*supra* Section IX.B.4) in the Li-Lee combination, the radio resources in the message 4 are determined by the UEs in accordance with an

²³ Claim 10 requires "the radio resources allocated to at least one of the first UE **OR** the second UE are further determined by at least one of the first UE **OR** the second UE according to an ID of at least one of the first UE **OR** the second UE in accordance with a pre-set rule." (Ex. 1001, claim 10 (emphasis added).) Therefore, the prior art reference need only teach the radio resources allocated to the first UE are further determined by the first UE according to an ID of at least one of the first UE in accordance with a pre-set rule to teach Claim 10.

ID thereof (i.e., the TC-RNTI) according to a pre-set rule (which is that the UEs with the correct TC-RNTI are able to descramble and decode the PDCCH corresponding to message 4). In other words, the Li-Lee combination disclose or suggests “the radio resources allocated to at least one of the first UE or the second UE are further determined by at least one of the first UE or the second UE according to an ID of at least one of the first UE or the second UE in accordance with a pre-set rule.”

C. Li and Zhao Disclose and/or Suggest the Limitations of Claim 12

- 1. Claim 12: “The method according to claim 7, further comprising: after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, receiving, by at least one of the first UE or the second UE, indicating information, sent by the eNB, for indicating re-initiation of a random access of at least one of the first UE or the second UE.”**

81. Li in combination with Zhao discloses or suggests claim 12. As discussed above with respect to claim 7, Li’s MTC UE1 receives a message 4 from the eNodeB. Specifically, in step 604, the eNodeB “returns an ACK to MTC UE1, for example, a RRC Connection ACK.” (Ex. 1005, ¶[0131].) Li does not, however, expressly disclose what happens if an ACK is not received from the eNodeB. For example, Li does not expressly disclose what happens if the eNodeB does not properly receive message 3 from the MTC UE1. (*Id.*) Zhao, however, discloses a random access procedure like Li’s but in which the eNodeB orders the UE to restart the random access procedure by resending a preamble.

82. Zhao discloses “random access procedures in wireless telecommunication networks and has particular relevant to random access procedures between a user equipment and radio access node” in LTE. (Ex. 1012, ¶[0001].) A radio access node (RAN) refers to an eNodeB. (*Id.*, ¶[0002].) Zhao discloses a random access procedure between a UE and an eNodeB with respect to Figure 4. In particular, the RAN 10 receives a preamble from the UE as part of MSG1 and responds with a MSG2 (which is the random access response). (*Id.*, ¶[0031].) “The UE . . . then responds by sending a third message (MSG3)” to the RAN. (*Id.*) But if the RAN fails to detect MSG3, it sends a HARQ NACK (*id.*) which is equivalent to a message 4, and the opposite of Li’s ACK. After sending the HARQ NACK, the eNodeB sends a “direct order” in step 80 to the UE “to restart the random access procedure with the same preamble.” (Ex. 1012, ¶[0031].) This procedure has the benefit of enabling the UE “to synchronize with the network.” (*Id.*) Therefore, Zhao discloses “after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, receiving, by at least one of the first UE or the second UE, indicating information, sent by the eNB, for indicating re-initiation of a random access of at least one of the first UE or the second UE,” as claimed.

83. Given that Zhao also discloses a random access procedure for LTE like Li, a person having ordinary skill in the art would have reason to look to Zhao to fill

in the gaps in Li's disclosure. Having looked to Zhao, a person having ordinary skill in the art would have been motivated to modify Li's random access procedure to incorporate Zhao's teachings regarding the eNodeB's instruction/command to the UE to restart random access procedure when, for example, message 3 is not successfully received or processed by the eNodeB. In such a combination, Li's eNodeB would send a NACK in message 4 (as opposed to an ACK, as disclosed in Li), and follow-up with a direct order to restart random access, like in Zhao. Incorporating such a technique in Li's disclosure would have provided the benefit of enabling the MTC UE1 "to synchronize with the network" in the event of the eNodeB not receiving or failing to process message 3. A person having ordinary skill in the art would have had a reasonable expectation of success in performing this modification of Li in view of Zhao given such a person's skill and the teachings of Zhao.

84. The above Li-Zhao combination discloses or suggests claim 12.

D. Li and Jiang Disclose and/or Suggest the Limitations of Claim 17

- 1. Claim 17: "The method according to claim 1, wherein sending, by the first UE in the UE group, the preamble over the time-frequency resource comprises: periodically sending, by the first UE, the preamble over the frequency domain resource."**

85. Li in combination with Jiang discloses or suggests claim 17. Li does not expressly disclose what happens if a random access response is not received by

MTC UE1 in step 602, after sending a random access preamble in step 601. That is Li does not expressly disclose what, if any, steps the MTC UE1 may take in order to continue the process of establishing a connection with the eNodeB if a response to the preamble sent by the UE1 is not received. (*Id.*) Jiang, however, discloses a similar setup as Li and in particular, explains that if a response is not received from the network side (i.e., from the eNodeB) within “a given time,” then the MTC terminal “can repeatedly send the Preamble.” (Ex. 1006, ¶[0044].)

86. Like Li, Jiang also discloses a random access procedure for MTC terminals belonging to a group. (*See id.*, ¶¶[0036]-[0038].) Like Li, Jiang discloses a random access process involving message 1 (sending of the random access preamble to the base station/eNB by the MTC UE), message 2 (random access response from the base station), message 3 (RRC connection request), and a message 4. (*Id.*, ¶¶[0039]-[0056].) Thus, a person having ordinary skill in the art would have reason to look to Jiang to improve upon or fill in gaps in the disclosure of Li. Having looked to Jiang, a person having ordinary skill in the art would have been motivated to combine the teachings of Li and Jiang to incorporate in Li, Jiang’s feature of repeatedly sending the Preamble if a random access response is not received from the eNodeB within a predetermined time interval. Doing so would have allowed the MTC UE1 in Li to continue to request a connection within the eNodeB in the absence of a response to the transmitted preamble within a given time window. A person

having ordinary skill in the art would have had a reasonable expectation of success in performing this modification of Li in view of Jiang given such a person's skill and the teachings of Jiang.

87. The above Li-Jiang combination discloses or suggests claim 17.

E. Kim and Li Disclose and/or Suggest the Limitations of Claims 1-4, 7, and 13

1. Claim 1

i) [1.pre] “A random access method, comprising:”

88. To the extent the preamble of claim 1 is limiting, Kim teaches or discloses the limitations therein. Kim discloses a method for performing a random access. (Ex. 1011, ¶[0083] (“FIG. 5 is a diagram illustrating operations of the UE and the eNB performed in the condition[*sic*]-based random access procedure.”).²⁴)

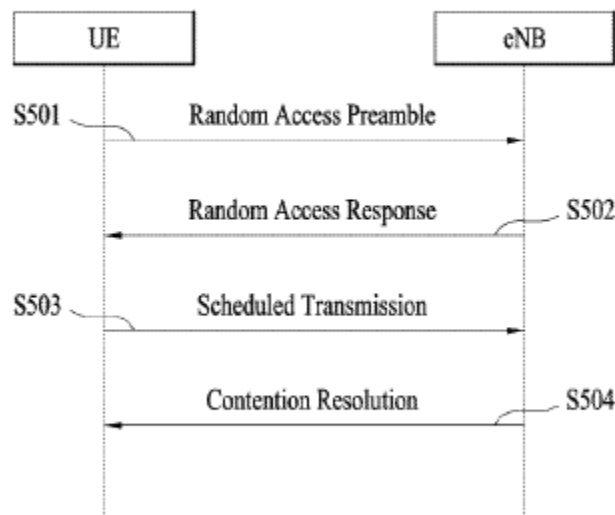
ii) [1.a] “sending, by a first User Equipment (UE) in a UE group, a preamble to an evolved Node B (eNB) over a time frequency resource;”

89. Kim in combination with Li discloses or suggests this limitation. Kim discloses that the UE transmits a random access preamble to the eNodeB over a PRACH resource in step 501. (Ex. 1011, ¶¶[0084]-[0085].) A PRACH refers “to a

²⁴ A person having ordinary skill in the art would have understood that this is a typographical error and Kim meant “contention” as opposed to “condition.”

set of time-frequency resources.” (*Id.*, ¶[0054].) Therefore, Kim discloses “sending, by a first User Equipment (UE) . . . , a preamble to an evolved Node B (eNB) over a time frequency resource.”

FIG. 5



(*Id.*, FIG. 5.)

90. To the extent it is found that Kim does not expressly disclose that the UE is “in a UE group,” as recited in claim [1.a], a person having ordinary skill in the art would have been motivated to include Kim’s UE as part of a UE group along with other UEs in view of Li’s teachings. For example, Li discloses a group of UEs “such as MTC UE1, MTC UE2, MTC UEn, MTC UEm, where n and m are positive integers larger than or equal to 2.” (Ex. 1005, ¶[0117].) And Li further discloses a

random access procedure implemented by the MTC UEs for communicating with an eNodeB. (*Id.*, ¶¶[0107]-[0133].) Given that both Kim and Li disclose random access procedure between a UE and an eNodeB, a person having ordinary skill in the art would have reason to look to Li to improve upon the teachings of Kim.

91. Having looked at Li, a person having ordinary skill in the art would have been motivated to include Kim's UE as part of a group of UEs because that would have increased the efficiency of the network. Specifically, it was well-known that "when too many users initiate access attempts simultaneously, multiple UEs may select the same random access resource, causing significantly increasing of average access delay for users. Meanwhile, a large amount of re-initiated access attempts may cause large overheads on UEs and eNB." (Ex. 1005, ¶[0022]; *see also id.*, ¶[0023].) By grouping UEs into UE groups (*id.*, ¶¶[0025]-[0028]), Li reduces "user access delay and lower[] the signaling overhead for signaling connection and data bearer establishment." (*Id.*, ¶[0024]; *see also id.*, ¶[0092].) Thus, a POSITA would have been motivated to include Kim's UE as a member of a UE group to obtain the various advantages derived from such grouping such as reducing user access delay and lowering signaling overhead, as explained by Li. Combining the teachings of Kim with Li would have constituted applying a known feature (Li's grouping technique) to a particular device (the system described in Kim) to achieve a predictable result (enabling random access by a group of UEs).

92. In such a combination, Kim's UE could serve the same role as Li's MTC UE1, which engages with the eNodeB to establish a connection (*supra* Section IX.A.1 (explaining the message sequence between MTC UE1 and the eNodeB as part of random access)). In other words, Kim's UE constitutes "a first User Equipment (UE) in a UE group" in the Kim-Li combination.

93. Thus, Kim combined with Li discloses or suggests limitation [1.a].

iii) [1.b] "the time-frequency resource comprising a time domain resource and a frequency domain resource;"

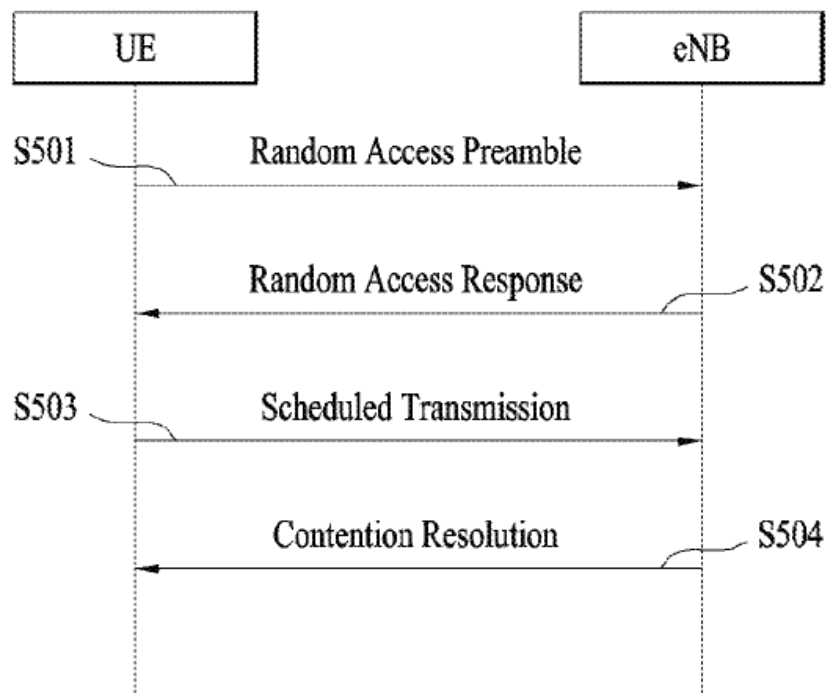
94. Kim in view of Li discloses or suggests this limitation. As discussed above, Kim discloses that the UE transmits a random access preamble to the eNodeB over a PRACH resource in step 501. (Ex. 1011, ¶[0084]-[0085].) A PRACH refers "to a set of time-frequency resources." (*Id.*, ¶[0054].) A person having ordinary skill in the art would have understood that "time-frequency" resources refer to a time domain (such as time slot) and a frequency domain resource. The inclusion of Kim's UE as part of a group would not have altered this aspect of Kim's disclosure given that Li discloses a similar transmission of a random access preamble over time-frequency resources. (*Supra* Section IX.A.1.ii.)

iv) [1.c] "monitoring, by at least one of the first UE or a second UE in the UE group, a Random Access Response (RAR) corresponding to the preamble and sent by the eNB"

95. Kim in view of Li discloses or suggests this limitation. For example, Kim discloses that “after transmitting the random access preamble as performed in step S401, the UE attempts to receive a random access response thereof within a random access response reception window Thereby, the UE may receive a UL grant, a temporary C-RNTI and a TAC.” (Ex. 1007, ¶[0087], FIG. 5.²⁵) As clear from Figure 5, the RAR is received from the eNB. Therefore, Kim discloses “monitoring” by the UE “a Random Access Response (RAR) corresponding to the preamble and sent by the eNB,” as claimed.

²⁵ A person having ordinary skill in the art would have understood that “S401” is a typographical error; instead, Kim intended to recite “S501” as evident from Figure 5.

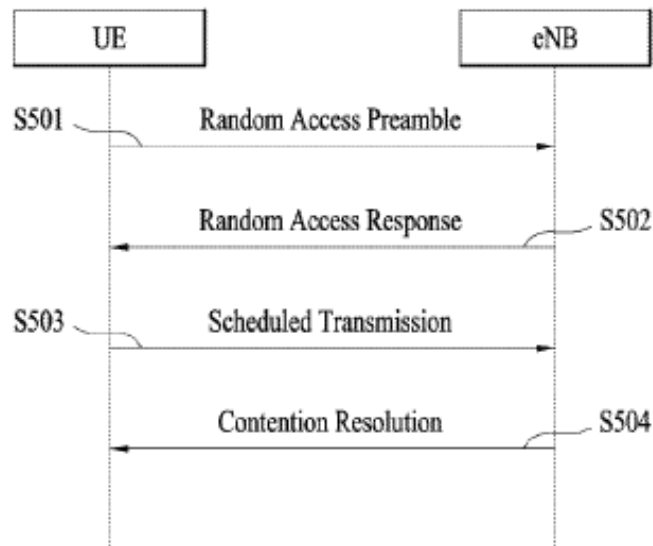
FIG. 5



(*Id.*, FIG. 5.)

96. Kim in combination with Li discloses that Kim's UE is part of a UE group (*supra* Section IX.E.1.ii (explaining that Kim's UE would be the "first UE" in the "UE group") and the inclusion of Kim's UE as a member of a UE group in view of Li does not affect this operation of Kim, as evidenced by a similar description of the random access response step in Li. (*Supra* Section IX.A.1.iii.) Therefore, Kim further discloses that the UE that monitors the RAR is "at least one of the first UE or a second UE in the UE group," as claimed.

FIG. 5



(Ex. 1011, FIG. 5.)

- v) [1.d] “wherein the first UE is at least one UE in the UE group, and the second UE is all or some UEs in the UE group;”

97. Kim in view of Li discloses or suggests this limitation. As discussed above, Li discloses that MTC UE1 is part of “a group, such as MTC UE1, MTC UE2, MTC UEn, MTC UEm, where n and m are positive integers larger than or equal to 2.” (Ex. 1005, ¶[0117].) Moreover, the RAR is monitored by “MTC UEn” (*id.*, ¶[0122]), which refers to “other terminals except the first terminal [MTC UE1]” (*id.*, ¶[0117].) Because Kim’s teachings are combined with Li such that Kim’s UE is a member of a group of UEs like in Li, the Kim-Li combination discloses

limitation [1.d]. (*Supra* Section IX.E.1.ii.) In particular, Kim in combination with Li discloses that Kim's UE is the "first UE" in the "UE group" just like Li's MTC UE1 is the "first UE" in the UE group with all other UE's constituting the "second UE." (*Id.*)

- vi) **[1.e] "after monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB, sending, by at least one of the first UE or the second UE, a message 3 according to a Uplink (UL) grant allocated thereto"**

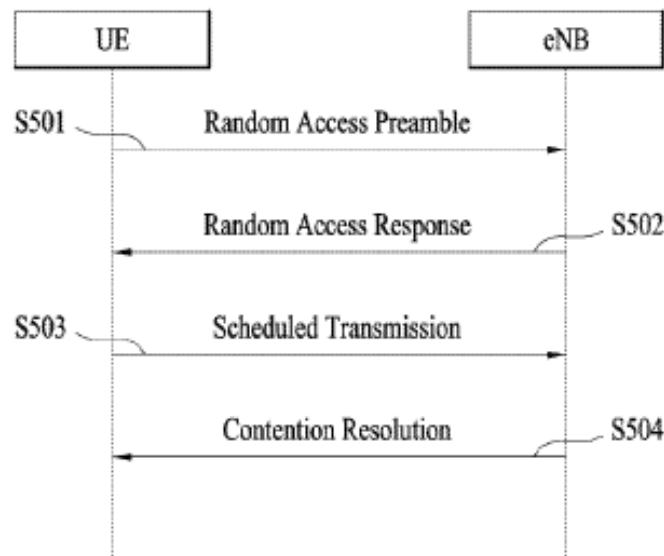
98. Kim in view of Li discloses or suggests this limitation.²⁶ Kim discloses that "[i]f the UE receives a valid random access response, the UE processes the information included in the random access response. That is, the UE applies the TAC and stores the temporary C-RNTI. In addition, the UE transmits data (i.e., message 3) to the eNB using the UL grant (S403)." (Ex. 1011, ¶¶[0089].²⁷) This discloses that Kim's UE monitors the RAR from the eNB, which is sent in response to the

²⁶ Claim limitation [1.e] requires "sending, by at least one of the first UE **OR** a second UE." (Ex. 1001, claim 1 (emphasis added).) Therefore, the prior art reference need only disclose sending by one of the UEs to anticipate claim limitation [1.e].

²⁷ A person having ordinary skill in the art would have understood that "S403" is a typographical error; instead, Kim intended to recite "S503" as evident from Figure 5.

preamble, and transmits a message 3 according to the UL grant in the RAR. The inclusion of Kim's UE as part of a UE group in view of Li does not affect this operation of Kim, as evidenced by a similar description of the random access response step in Li. (*Supra* Section IX.A.1.vi.) Again, Kim's UE constitutes the "first UE" in the Kim-Li combination. (*Supra* Section IX.E.1.ii.)

FIG. 5



(Ex. 1011, FIG. 5.)

- vii) [1.f] “wherein the message 3 comprises a number of UEs having random access requests in the UE group or a number of UEs contained in the UE group or a pre-set UE number.”

99. Kim in view of Li discloses or suggests this limitation.²⁸ Kim discloses that “[m]essage 3 should include an ID of the UE. This is because the eNB cannot determine which UEs perform the random access procedure in the contention-based random access procedure and the UEs need to be identified for future contention resolution.” (Ex. 1011, ¶[0089].) The UE ID may be a “unique ID (e.g., System Architecture Evolution (SAE)-Temporary Mobile Subscriber Identity (S-TMSI) or a random ID).” (*Id.*, ¶[0090].) For example, S-TMSI is a number expressed in 40 bits. Therefore, Kim discloses that the UE ID is a “pre-set UE number.” The inclusion of Kim’s UE as a member of a UE group in view of Li does not affect this operation of Kim, as evidenced by a similar description of the random access response step in Li. (*Supra* Section IX.A.1.vii.)

2. **Claim 2: “The method according to claim 1, wherein the first UE is at least one of the following: at least one fixed UE; or, at least one UE determined according to a pre-set rule; or, at least one UE notified by the eNB.”**

²⁸ Claim limitation [1.f] requires “a number of UEs having random access requests in the UE group **OR** a number of UEs contained in the UE group **OR** a pre-set UE number.” (Ex. 1001, claim 1 (emphasis added).) Therefore, the prior art reference need only disclose a pre-set UE number to anticipate claim limitation [1.f].

100. Kim in view of Li discloses or suggests this claim. Kim discloses that the “random access preamble” sent by the UE in step 501 is selected “from a set of random access preambles indicated through system information.” (Ex. 1011, ¶¶[0085].) The system information is, however, provided to the UE by the eNodeB. (See, e.g., *id.*, ¶¶[0080].) Thus, Kim’s UE, which is the “first UE” in the combination with Li, is “notified by the eNB” as claimed because the eNB notifies the UE of the permissible preambles for random access. Furthermore, Kim discloses that the UE may be selected as a “transmission (TX) UE performing D2D communication” and the “eNB may assign a resource” to such Tx UE. (*Id.*, ¶[0092].) For this additional reason, Kim discloses that at least one UE determined according to a pre-set rule. The inclusion of Kim’s UE as part of a UE group in view of Li would not have affected this operation of Kim because the UEs still need access to random access preambles, which is the responsibility of the eNodeB.

3. Claim 3: “The method according to claim 1, wherein at least one of the preamble, the time domain resource or the frequency domain resource is pre-set, or determined by a group Identifier (ID) of the UE group, or notified by the eNB.”

101. Kim in view of Li discloses or suggests this claim. As discussed above with respect to claim 2, Kim discloses that the “random access preamble” sent by the UE in step 501 is selected “from a set of random access preambles indicated through system information.” (Ex. 1011, ¶¶[0085].) And the system information is

notified by the eNodeB. (*See, e.g., id.*, ¶¶[0080].) Therefore, at least the preamble is notified by the eNB.

4. **Claim 4: “The method according to claim 3, wherein at least one of the preamble, the time domain resource or the frequency domain resource corresponds to the number of UEs having random access requests in the UE group or the number of UEs contained in the UE group or the pre-set UE number.”**

102. Kim in view of Li discloses or suggests this limitation. Kim discloses that “transmission of msg1 ... may be performed using a time and resource determined based on a unique attribute (e.g., ID) of the UE.” (Ex. 1011, ¶[0188].)

5. **Claim 7: “The method according to claim 1, further comprising: after sending, by at least one of the first UE or the second UE, the message 3 according to the UL grant allocated thereto, receiving, by at least one of the first UE or the second UE, a message 4 sent by the eNB.”**

103. Kim in view of Li discloses or suggests this claim. Kim discloses that the UE receives a message 4 after sending message 3. (Ex. 1011, ¶¶[0091]-[0092], FIG. 5.) The inclusion of Kim’s UE as part of a UE group in view of Li does not affect this operation of Kim, as evidenced by a similar description of the random access response step in Li.

6. **Claim 13: “The method according to claim 7, wherein the message 3 and the message 4 comprise a group ID of the UE group or a preset field.”**

104. Kim in view of Li discloses or suggests this claim. As discussed above with respect to claim [1.f], message 3 includes the UE's ID. (*Supra* Section IX.E.1.vii.) The UE's ID is a "preset field."

F. Kim, Li, and Lee Disclose and/or Suggest the Limitations of Claims 5, 6, and 8-10

1. Claim 5: "The method according to claim 1, wherein"²⁹

105. Kim in combination with Li and Lee discloses or suggests or discloses or suggests this limitation.

i) [5.a] "monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB comprises:

(a) "descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a pre-set Random Access Radio Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble, and receiving the RAR, the RAR comprising at least one of at least one Temporary Cell Radio Network Temporary Identity (TC-RNTI) or at least one Uplink (UL) grant; and"

106. As discussed above with respect to claim limitation [1.c], Kim discloses that "after transmitting the random access preamble as performed in step S401, the

²⁹ Claim 5 recites two alternatives separated by "or." I group these alternatives as claim limitation [5a] and [5b]. The prior art need only disclose [5a] or [5b].

UE attempts to receive a random access response thereof within a random access response reception window Thereby, the UE may receive a UL grant, a temporary C-RNTI and a TAC.” (Ex. 1011, ¶[0087], FIG. 5.³⁰) Therefore, Kim discloses “receiving the RAR, the RAR comprising at least one of at least one Temporary Cell Radio Network Temporary Identity (TC-RNTI) or at least one Uplink (UL) grant,” as claimed.

107. To the extent it is argued that Kim does not disclose “descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a pre-set Random Access Radio Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble” as recited in claim [5.a], Lee discloses such a feature for the reasons I set forth in Section IX.B.1.i. Specifically, Lee discloses the following: the PDCCH has CRC that is scrambled; the UE descrambles the CRC of the PDCCH using the RA-RNTI associated with the UE’s transmitted preamble; the PDCCH conveys DCI which indicates the PDSCH, which includes the RAR. (*Supra* Section IX.B.1.i.) Given that Kim, Li, and Lee disclose random access procedure

³⁰ A person having ordinary skill in the art would have understood that “S401” is a typographical error; instead, Kim intended to recite “S501” as evident from Figure 5.

between a UE and an eNodeB, a person having ordinary skill in the art would have reason to look to Lee to improve upon the teachings of the Kim-Li combination.

108. Having looked at Lee, a person having ordinary skill in the art would have been motivated to enable the Kim-Li UE to descramble the CRC corresponding to a PDCCH (“DCI”) according to the teachings of Lee. Specifically, Kim discloses that the random access response is received on the PDSCH indicated by the PDCCH, which includes DCI. (Ex. 1011, ¶[0087] (referring to the RAR process of figure 4), ¶[0080].) This is the same process as described in Lee. (Ex. 1007, 12:47-62.) Lee, however, further elaborates on the same process and describes that CRC bits are attached to the DCI, and are scrambled. (*Supra* Section IX.B.1.i.) Thus, a person having ordinary skill in the art would have been motivated to incorporate into the Kim-Li combination, the CRC scrambling and descrambling process described in Lee such that the UE may properly receive the random access response that is transmitted to the PDSCH according to the PDCCH information that is obtained as a result of descrambling the CRC. Importantly, as disclosed by Lee, the PDCCH has associated CRC bits that are scrambled using an identifier ideally unique to the UE to which that PDCCH is directed. This enables the correct UE with the identifier to receive the PDCCH intended for it because only that UE can descramble the CRC bits of the PDCCH. Thus, combining the teachings of Lee with Li would have been apparent because it would have constituted applying a known feature (Lee’s

techniques) to a particular device (the Kim-Li eNB and UEs) to achieve a predictable result (enabling reception of a random access response by the UE to which the response is directed).

109. Moreover, a POSITA would have had a reasonable expectation of success implementing such a combination. For example, such person knew how to implement scrambling and descrambling of DCI, and further knew how PDDCH and PUSCH operated in the context of random access. Utilizing Lee's techniques with the Kim-Li combination would have been well within the skills of a POSITA and would have merely required basic programming to configure the eNodeB and UEs to utilize Lee's above-noted techniques.

110. Thus, Kim in combination with Li and Lee discloses or suggests the limitation.

(b) “determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR; or”

111. Kim discloses that the UE utilizes the UL grant resources allocated to it by the eNodeB in the RAR. (Ex. 1007, ¶[0089].) In other words, the UE determines the UL grant according to the UL grant contained in the RAR.

ii) [5.b] “monitoring, by at least one of the first UE or

the second UE, the RAR corresponding to the preamble and sent by the eNB comprises: determining, by at least one of the first UE or the second UE, corresponding RA-RNTIs according to at least one of respective IDs or preambles, descrambling a CRC of DCI for scheduling the RAR according to the corresponding RA-RNTIs, and receiving corresponding RARs, the RAR comprising at least one of a TC-RNTI or a UL grant allocated to the first UE or second UE.”

112. This is an optional feature and need not be disclosed because [5.a] is disclosed.

2. **Claim 6: “The method according to claim 5, wherein determining, by at least one of the first UE or the second UE, at least one of the TC-RNTI or the UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR comprises: determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or a UL grant allocated thereto according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule.”**

113. Kim in combination with Li and Lee discloses or suggests this claim. Kim discloses that the UE utilizes the T-CRNTI and the UL grant resources allocated to it by the eNodeB in the RAR. (Ex. 1011, ¶¶[0087]-[0089].) Thus, Kim discloses that the UE determines the T-CRNTI and the UL grant from the information in the RAR.

114. Furthermore, as discussed above with respect to claim 5, in the Kim-Li-Lee combination, the UE detects the PDCCH to receive the RAR, and more

specifically, the “UE . . . detects the PDCCH masked with RA-RNTI.” (Ex. 1007, 19:18-24.) The RA-RNTI is an “ID” of the UE because an RNTI it is a “unique identity given to a terminal.” (*Id.*, 19:33-35.) Therefore, the RAR (and its contents including the T-CRNTI and the UL grant) are determined “according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule,” as claimed. The fact that the PDCCH is masked with the RA-RNTI is a “pre-set rule.”

3. Claim 8: “The method according to claim 7, wherein receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB comprises: scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE.”

115. Kim in combination with Li and Lee discloses or suggests or discloses or suggests this limitation. As discussed above, Kim’s UE (“the first UE” in the Kim-Li combination) receives a message 4 sent by the eNB. (Ex. 1011, ¶¶[0091]-[0092], FIG. 5.) Kim further notes that, for receiving message 4 from the eNB, “the UE may attempt to receive a PDCCH using the temporary C-RNTI included in the random access response.” (*Id.*, ¶[0092].) To a person having ordinary skill in the art, this simply means that the CRC of the PDCCH (which is “DCI”) is scrambled by the eNB and the UE descrambles this CRC using the temporary C-RNTI (T-CRNTI).

116. To the extent it is argued that such a feature is not apparent from Kim, Lee discloses that a message 4 pertaining to contention resolution is transmitted by the eNodeB to the UE after receiving message 3. (Ex. 1007, 21:47-22:15.) And transmission of message 4 involves the transmission of a PDCCH by the eNodeB, which the UE attempts to receive “using the TC-RNTI” of the UE. (*Id.*) As discussed above with respect to claim 5 in Section IX.B.1, a person having ordinary skill in the art would have understood that “using the TC-RNTI” means that the CRC bits of the PDCCH are scrambled by the eNodeB using the “TC-RNTI,” which the UE then uses to descramble the CRC bits and receive the PDCCH. That is, Lee discloses “scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE.”

117. A person having ordinary skill would have been motivated to combine the Kim-Li combination with Lee’s teachings of scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to the first UE, in view of Lee’s similarity to both Kim and Li. (Section IX.F.1.i, *supra* (explaining similarities between Kim, Li and Lee).) Having looked at Lee, a POSITA would have been motivated to enable the Kim-Li combination eNodeB to scramble a CRC of DCI for scheduling the message 4 according to the teachings of Lee. Specifically, by scrambling the CRC, the eNodeB can “resolve contention” with the “relevant UE” that has not been assigned a C-RNTI. (Ex. 1007, 21:48-22:15.) As explained above

with respect to claim 5, adding CRC bits to a PDCCH and scrambling them allows the PDCCH to be received by the intended UE and a POSITA would have been able to make the relevant changes to Kim-Li system to implement such a modification.

118. Thus, Kim and Li in view of Lee discloses or suggests this claim.

4. **Claim 9: “The method according to claim 8, wherein the message 4 comprises at least one set of radio resources, radio resources allocated to at least one of the first UE or the second UE are determined by at least one of the first UE or the second UE according to at least one set of radio resources in the message 4; or the message 4 comprises a set of radio resources allocated to the first UE or second UE.”**

119. Kim in combination with Li and Lee discloses or suggests this claim. Kim discloses that the UE receives a message 4 after sending message 3. (Ex. 1011, ¶¶[0091]-[0092], FIG. 5.) To the extent it is argued that Kim does not expressly disclose that the message 4 “comprises a set of radio resources allocated to the first UE or second UE,” both Lee and Li disclose allocating radio resources to enable the UE to transition to an RRC connected state. (See my analysis above in Section IX.B.4.) For example, Lee discloses that “the RRC connection setup message [i.e., message 4] includes configuration information for setting SRB1” and “by transmitting the RRC connection setup message to the terminal” (the UE), the “BS” (eNB) “allocates SRB (e.g., SRB 1) configuration resource to be dedicatedly used by the terminal.” (Ex. 1007, 14:63-67.)

120. A person having ordinary skill in the art would have been motivated to modify the Kim-Li-Lee combination to include such radio resources in Kim's message 4 so as to allow the UE to transition to an RRC connected state. (*See* my analysis above in Section IX.B.4.) And the person of ordinary skill would have had a reasonable expectation of success in making such a modification for the reasons I discussed in Section IX.B.4.

- 5. Claim 10: “The method according to claim 9, wherein the radio resources allocated to at least one of the first UE or the second UE are further determined by at least one of the first UE or the second UE according to an ID of at least one of the first UE or the second UE in accordance with a pre-set rule.”**

121. Kim in combination with Li and Lee discloses or suggests this claim. For example, as discussed above with respect to claim 9, in the Kim-Li-Lee combination, the UE receives radio resources allocated thereto by the eNodeB. (*Supra* Section IX.F.4.) Furthermore, in the Kim-Li-Lee combination, the message 4 is deciphered by the UE using a TC-RNTI of the UE. (*Supra* Section IX.F.3.) Because message 4 includes the radio resources (*supra* Section IX.F.4) in the Kim-Li-Lee combination, the radio resources in the message 4 are determined by the UE in accordance with an ID thereof (i.e., the TC-RNTI) according to a pre-set rule (which is that the UE with the correct TC-RNTI is able to descramble and decode the PDCCH corresponding to message 4). Therefore, the Kim-Li-Lee combination

disclose or suggests “the radio resources allocated to at least one of the first UE or the second UE are further determined by at least one of the first UE or the second UE according to an ID of at least one of the first UE or the second UE in accordance with a pre-set rule.”

G. Kim, Li, and Zhao Disclose and/or Suggest the Limitations of Claim 12

- 1. Claim 12: “The method according to claim 7, further comprising: after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, receiving, by at least one of the first UE or the second UE, indicating information, sent by the eNB, for indicating re-initiation of a random access of at least one of the first UE or the second UE.”**

122. Kim in view of Li and Zhao discloses or suggests claim 12. As discussed above with respect to claim 7, Kim discloses that the UE receives a message 4 after sending message 3. (Ex. 1011, ¶¶[0091]-[0092], FIG. 5.) Kim does not, however, explicitly disclose what happens if a message 4 is not received from the eNodeB. For example, Kim does not explicitly disclose what happens if the eNodeB does not properly receive message 3 from the UE. Zhao, however, discloses a random access procedure just like Kim’s but in which the eNodeB orders the UE to restart the random access procedure by resending a preamble. Zhao discloses “after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, receiving, by at least one of the first UE or the second UE, indicating

information, sent by the eNB, for indicating re-initiation of a random access of at least one of the first UE or the second UE,” as claimed. (*Supra* Section IX.C.)

123. Given that Zhao also discloses a random access procedure for LTE like Kim, a person having ordinary skill in the art would have reason to look to Zhao to fill in the gaps in Kim’s disclosure. Having looked to Zhao, a person having ordinary skill in the art would have been motivated to modify the Kim-Li combination’s random access procedure to incorporate Zhao’s teachings regarding the eNodeB’s instruction/command to the UE to restart random access procedure when, for example, message 3 is not successfully received or processed by the eNodeB. Incorporating such a technique in the Kim-Li combination would have provided the benefit of enabling the UE “to synchronize with the network” in the event of the eNodeB not receiving or failing to process message 3. A person having ordinary skill in the art would have had a reasonable expectation of success in performing this modification of the Kim-Li combination in view of Zhao given such a person’s skill and the teachings of Zhao.

124. The above Kim-Li-Zhao combination discloses or suggests claim 12.

H. Kim, Li, and Jiang Disclose and/or Suggest the Limitations of Claim 17

- 1. Claim 17: “The method according to claim 1, wherein sending, by the first UE in the UE group, the preamble over the time-frequency resource comprises: periodically**

sending, by the first UE, the preamble over the frequency domain resource.”

125. Kim in combination with Li and Jiang discloses or suggests claim 17. Kim does not explicitly disclose what happens if a random access response is not received by the UE after sending a random access preamble to the eNodeB. That is Kim does not explicitly disclose what, if any, steps the UE may take to continue the process of establishing a connection with the eNodeB if a response to the preamble sent by the UE is not received. Jiang, however, discloses a similar setup as Kim and in particular, explains that if a response is not received from the network side (i.e., from the eNodeB) within “a given time,” then the MTC terminal “can repeatedly send the Preamble.” (Ex. 1006, ¶[0044].)

126. Like the Kim-Li combination, Jiang also discloses a random access procedure for UEs belonging to a group. (*See id.*, ¶¶[0036]-[0038].) Like Kim and Li, Jiang discloses a random access process involving message 1 (sending of the random access preamble to the base station/eNB by the MTC UE), message 2 (random access response from the base station), message 3 (RRC connection request), and a message 4. (*Id.*, ¶¶[0039]-[0056].) Thus, a person having ordinary skill in the art would have reason to look to Jiang to improve upon or fill in gaps in the disclosure of Kim. Having looked to Jiang, a person having ordinary skill in the art would have been motivated to combine the teachings of Kim, Li and Jiang to

incorporate in the Kim-Li combination, Jiang's feature of repeatedly sending the Preamble if a random access response is not received from the eNodeB within a predetermined time interval. Doing so would have allowed the UE to continue to request a connection within the eNodeB in the absence of a response to the transmitted preamble within a given time window. A person having ordinary skill in the art would have had a reasonable expectation of success in performing this modification of Kim and Li in view of Jiang given such a person's skill and the teachings of Jiang.

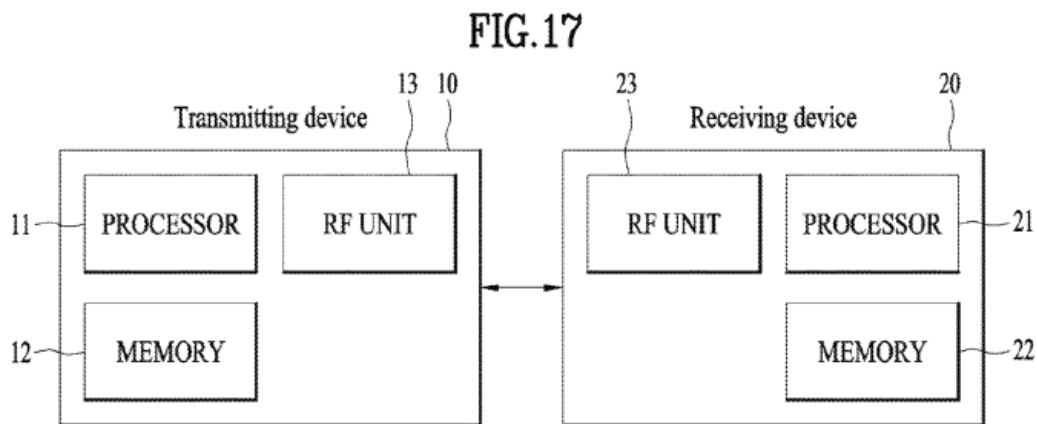
127. The above Kim-Li-Jiang combination discloses or suggests claim 17.

I. Kim Discloses Claim 18

1. Claim 18:

i) [18.pre] “A User Equipment (UE), comprising:”

128. Kim discloses the limitations therein. “FIG. 17 is a block diagram illustrating elements of a transmitting device 10 and a receiving device 20 for implementing the present invention.” (Ex. 1011, ¶[0234].) “In the embodiments of the present invention, a UE operates as the transmitting device 10 in UL and as the receiving device 20 in DL.” (*Id.*, ¶[0241].) UL refers to uplink and DL refers to downlink.



(*Id.*, FIG. 17.)

ii) [18.a] “a sending unit, and a monitoring unit,”³¹

129. Kim discloses this limitation. Based on Figure 17, Kim’s UE includes a processor and an RF unit that together perform the various functions of the UE. (Ex. 1011, ¶¶[0235]-[0239].) For example, the processor and RF unit work in conjunction to transmit msg1, receive msg2, and transmit msg 3. (*Id.*, ¶[0242].) Thus, the processor and RF unit combine to form both a sending unit and a monitoring unit.

iii) [18.b] “wherein the sending unit is configured to :
send a preamble to an evolved Node B (eNB) over a
time – frequency resource , the time-frequency
resource comprising a time domain resource and a
frequency domain resource,”

130. Kim discloses this limitation. Kim discloses that the UE sends a preamble to an eNB over a time-frequency resource. (*Supra* Section IX.E.1.ii-iii.) A POSITA would have further understood that disclosure of Figure 17 would have been applicable to the above-identified function of sending a preamble over a time-frequency resource. For example, the UE must have some hardware and software

³¹ For the terms “sending unit” and “monitoring unit,” there is no corresponding structure (e.g., an algorithm) disclosed in the ’430 patent. For example, the ’430 patent merely notes that each “function unit . . . may be implemented by using a general computation apparatus.” (Ex. 1001, 29:44-46.)

that is configured to carry out the recited functions (e.g., sending a preamble). And Figure 17 discloses such hardware while noting that the processor and RF unit work in conjunction to transmit msg1 (Ex 1011, ¶[0242]), which in the case of Kim is the sending of the preamble to the eNB. (*Supra* Section IX.E.1.ii-iii.)

iv) [18.c] “the monitoring unit is configured to : monitor a Random Access Response (RAR) corresponding to the preamble and sent by the eNB ;”

131. Kim discloses this limitation. Kim discloses that the UE monitors an RAR. (*Supra* Section IX.E.1.iv.) A POSITA would have further understood that disclosure of Figure 17 would have been applicable to the above-identified function of the UE. The UE must have some hardware and software that are configured to carry out the recited functions (e.g., sending a preamble). And Figure 17 discloses such hardware while noting that the processor and RF unit work in conjunction to receive msg 2 (Ex 1011, ¶[0242]), which in the case of Kim is the receiving of the RAR from the eNB (*supra* Section IX.E.1.iv.).

v) [18.d] “the sending unit is further configured to: send a message 3 according to a Uplink (UL) grant allocated to the UE,”

132. Kim discloses this limitation. Kim discloses that the UE transmits a message 3 according to a UL grant allocated to the UE. (*Supra* Section IX.E.1.vi.) A POSITA would have further understood that disclosure of Figure 17 would have been applicable to the above-identified function of the UE. The UE must have some

hardware and software that is configured to carry out the recited function (e.g., sending message 3). And Figure 17 discloses such hardware while noting that the processor and RF unit work in conjunction to receive msg 3 (Ex 1011, ¶[0242]), which in the case of Kim is the sending of message 3 (*supra* Section IX.E.1.vi.).

- vi) **[18.e] “wherein the message 3 comprises a number of UEs having random access requests in a UE group or a number of UEs contained in the UE group or a pre-set UE number.”**

133. Kim discloses this limitation. Kim discloses that the message 3 includes a pre-set UE number. (*See* Section IX.E.1.vii.)

X. CONCLUSION

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

Dated: January 4, 2023

By: _____



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