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Title: Providing Improved Scheduling Request Signaling With
ACK/NACK Or CQI

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DECLARATION OF NARAYAN MANDAYAM, PH.D.

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I. Introduction

I, Dr. Narayan Mandayam, declare as follows:

1. I have been retained on behalf of Petitioner, Huawei Technologies Co. Ltd., to provide expert opinions in connection with this *inter partes* review. Specifically, I have been asked to provide my opinion relating to an inquiry into the patentability of claims of the U.S. Patent No. 9,185,688 (the “’688 Patent”).

II. Qualifications

2. I received a bachelor degree (with Honors) in 1989 from the Indian Institute of Technology, Kharagpur, and M.S. and Ph.D. degrees in 1991 and 1994 from Rice University, Houston, TX, all in electrical engineering.

3. I was a Research Associate at the Wireless Information Network Laboratory (“WINLAB”), Department of Electrical and Computer Engineering, Rutgers University, between 1994 and 1996. In September 1996, I joined the faculty of Department of Electrical & Computer Engineering at Rutgers where I became Associate Professor in 2001, Professor in 2003, and Distinguished Professor in 2014. I also served as the Peter D. Cherasia Endowed Faculty Scholar at Rutgers University from 2010 to 2014. Currently, I also serve as the Chair of the Electrical and Computer Engineering Department as well as Associate Director at WINLAB where I conduct research in various aspects of wireless systems and networks. I teach

courses at Rutgers on the topics of Wireless System Design, Wireless Communication Technologies, Wireless Revolution, Detection and Estimation Theory and Introduction to Computing for Engineers. I was a visiting faculty fellow in the Department of Electrical Engineering, Princeton University in Fall 2002 and a visiting faculty at the Indian Institute of Science in Spring 2003.

4. My research focuses on wireless networks and communications, and I have worked on various aspects of networking and wireless devices. Over the last 25 years, I have published a wide range of articles on various aspects of wireless systems including techniques for data transmission, resource allocation strategies, mathematical modeling, and performance analysis. Using constructs from game theory, communications and networking, my work has focused on system modeling and performance, signal processing as well as radio resource management for enabling wireless technologies to support various applications. I have coauthored 2 books on wireless networks (Principles of Cognitive Radio, Cambridge (2012) and Wireless Networks: Multiuser Detection in Cross-Layer Design, Springer (2005)), 6 book chapters and published over 200 papers in prestigious international journals and conferences. I have also given numerous invited presentations at a variety of industry, government, and academic forums.

5. Specifically, I have been doing precompetitive research in various aspects of wireless data transmission for over 25 years addressing PHY, MAC and

Network layer issues. I have made seminal research contributions to wireless data communications on issues ranging from the systems level (such as power control, base station assignment, capacity evaluation, protocol design, medium access control, and radio resource management) to the physical layer (such as detection and estimation). My expertise includes cellular systems such as for 2G, 3G and 4G and I have published papers on a wide variety of topics related to the design and operation of GSM/TDMA, CDMA and LTE based systems. Specifically, I have researched and published my findings on topics such as Orthogonal Frequency Division Multiple Access (OFDMA), Noncontiguous OFDMA, MIMO, Pilot Contamination, and Transceiver and Code Design. During this time, I have also worked extensively on wireless local area network (WLAN) technologies as well as wireless ad-hoc and sensor networks, and as such, I am quite familiar with 802.11 and Bluetooth.

6. I also teach both graduate and undergraduate courses at Rutgers where I introduce students to the wide area network (WAN) cellular and local area network (LAN) technologies mentioned above. I have also served as a technical consultant since its inception in 2002 to the company Mojo Networks Inc., a world leader in enterprise network security for WLANs that offers the next generation of intelligent edge, secure, and flexible WiFi solutions. I am familiar with the early developments in the area of cellular systems (2G, 3G, 4G and 5G) and have served on several

graduate thesis defense committees pertaining to all aspects of cellular systems operation.

7. I have received several prestigious awards relating to my research on wireless networks and communications: the 2015 IEEE COMSOC Advances in Communications Award for seminal work on power control in wireless data networks (this is the highest paper award given by the IEEE Communications Society), the 2014 IEEE Donald G. Fink Award (recognizes the most outstanding tutorial paper across all IEEE publications) for the paper titled “Frontiers of Wireless and Mobile Communications” that discusses the historical and future landscape of both WAN and LAN wireless technologies, and the Fred W. Ellersick Prize from the IEEE Communications Society in 2009 for work on dynamic spectrum access models and spectrum policy. I also received the Peter D. Cherasia Faculty Scholar Award from Rutgers University in 2010, the National Science Foundation Career Award in 1998, and the Institute Silver Medal from the Indian Institute of Technology, Kharagpur in 1989.

8. I have served as an Editor for the journals IEEE Communication Letters (1999- 2002) and IEEE Transactions on Wireless Communications (2002-2004). I have also served as a guest editor of the IEEE JSAC Special Issues on Adaptive, Spectrum Agile and Cognitive Radio Networks (2007) and Game Theory in Communication Systems (2008). I was elected Fellow of the IEEE for “contributions to

wireless data transmission.” I have also served as a Distinguished Lecturer of the IEEE Communications Society.

9. My Curriculum Vitae is attached as HUAWEI-1004, which contains further details on my education, experience, publications, and other qualifications to render an expert opinion. My work on this case is being billed at an hourly rate, with reimbursement for actual expenses. My compensation is not contingent upon the outcome of this *inter partes* review.

III. Materials Considered

10. In forming my opinions expressed in this declaration, I have considered and relied upon my education, background, and experience. I reviewed U.S. Patent No. 9,185,688 (the “‘688 Patent”, HUAWEI-1001) and its patent file history (Exhibit 1002).

11. Additionally, I have reviewed and relied upon the following list of materials in preparation of this declaration:

- HUAWEI-1005 U.S. Patent No. 7,852,883 to Kwak *et al.* (“KwakPat883”)
- HUAWEI-1006 Prosecution History of KwakPat883
- HUAWEI-1007 Prosecution History of Provisional Application No. 60/954,812 of KwakPat883 filed on Aug. 8, 2007, including its Certified English Translation (“KwakProv812”)

- HUAWEI-1009 Prosecution History of Provisional Application No. 60/979,860 of KwakPat883 filed on Oct. 14, 2007, including its Certified English Translation (“KwakProv860”)

- HUAWEI-1011 U.S. Patent Application Publication No. US 2008/0316959 to Bachl *et al.* (“Bachl”)

- HUAWEI-1012 U.S. Patent Application Publication No. US 2009/0022135 to Papasakellariou *et al.* (“Papasakellariou”)

- HUAWEI-1013 3GPP TSG-RAN WG1 Meeting #50, doc R1-073485, *Proposed Scheduling Request (SR) structure and multiplexing with PUCCH* (August 20-24, 2007), available as “R1-073485.zip”, http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_50/Docs/ (uploaded 8/15/2007, p.2:07 PM) (“LGE”)

- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- HUAWEI-1017 3GPP TSG-RAN WG1 Meeting #49bis, doc R1-073011, *Multiplexing of Scheduling Request and ACK/NACK and/or CQI* (June 25

– 29, 2007), available as “R1-073011.zip”, at

http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_49b/Docs/

- HUAWEI-1018 U.S. Patent No. 5,544,156 to Teder *et al.* (“Teder”)
- HUAWEI-1019 U.S. Patent Application Publication Number US 2007/0171849 to Zhang *et al.* (“Zhang”)
- HUAWEI-1020 U.S. Patent No. 8,094, 554 to Gholmieh *et al.* (“Gholmieh”)
- HUAWEI-1021 U.S. Patent No. 7,881,398 to Mujtaba *et al.* (“Mujtaba”)
- HUAWEI-1022 Frequently Asked Questions, available at http://web.archive.org/web/20070630180057/http://www.3gpp.org:80/faq/faq_2005_2.htm (“3GPP FAQ”)
- HUAWEI-1024 3GPP Webpage, available at <http://web.archive.org/web/20070703092005/http://www.3gpp.org:80/About/about.htm> (“About 3GPP”)
- HUAWEI-1025 Dictionary Definition of “allocate”
- HUAWEI-1027 U.S. Patent No. 9,148,877 to Pajukoski, et al. (“the ‘877 Patent”)

- HUAWEI-1028 Excerpts from the Prosecution History of the '877

Patent (“the Prosecution History of the '877 Patent”)

- I have also considered all other materials cited herein.

IV. Applicable Legal Standards

A. *My Understanding of Anticipation*

12. I understand that documents and materials that qualify as prior art can be used to invalidate a patent claim as anticipated or as obvious.

13. I understand that, once the claims of a patent have been properly construed, the second step in determining anticipation of a patent claim requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

14. I understand that a prior art reference “anticipates” an asserted claim, and thus renders the claim invalid, if all elements of the claim are disclosed in that prior art reference, either explicitly or inherently (*i.e.*, necessarily present).

15. I understand that anticipation in an *inter partes* review must be shown by a preponderance of the evidence.

B. *My Understanding of Obviousness*

16. I understand that a patent claim is invalid if the claimed invention would have been obvious to a person of ordinary skill in the field at the time of the claimed invention. This means that even if all of the requirements of the claim cannot

be found in a single prior art reference that would anticipate the claim, the claim can still be invalid.

17. As part of this inquiry, I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. In deciding the level of ordinary skill, I considered the following:

- the levels of education and experience of persons working in the field;
- the types of problems encountered in the field; and
- the sophistication of the technology.

18. To obtain a patent, a claimed invention must have, as of the priority date, been nonobvious in view of the prior art in the field. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a person having ordinary skill in the art.

19. I understand that a person of ordinary skill in the art provides a reference point from which the prior art and claimed invention should be viewed. This reference point prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious.

20. I also understand that an obviousness determination includes the consideration of various factors such as (1) the scope and content of the prior art, (2) the differences between the prior art and the asserted claims, (3) the level of ordinary

skill in the pertinent art, and (4) the existence of secondary considerations such as commercial success, long-felt but unresolved needs, failure of others, etc.

21. I understand that an obviousness evaluation can be based on a combination of multiple prior art references. I understand that the prior art references themselves may provide a suggestion, motivation, or reason to combine, but other times the nexus linking two or more prior art references is simple common sense. I further understand that obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references may be supplied by the direction of the marketplace.

22. I understand that if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

23. I also understand that practical and common sense considerations should guide a proper obviousness analysis, because familiar items may have obvious uses beyond their primary purposes. I further understand that a person of ordinary skill in the art looking to overcome a problem will often be able to fit together the teachings of multiple publications. I understand that obviousness analysis therefore takes into account the inferences and creative steps that a person of ordinary skill in the art would employ under the circumstances.

24. I understand that a particular combination may be proven obvious merely by showing that it was obvious to try the combination. For example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reasons to pursue the known options within his or her technical grasp because the result is likely the product not of innovation but of ordinary skill and common sense.

25. The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, the patent claim is likely obvious.

26. It is further my understanding that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill in the art, not just the patentee. Accordingly, I understand that any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

27. I understand that a claim can be obvious in light of a single reference, without the need to combine references, if the elements of the claim that are not

found explicitly or inherently in the reference can be supplied by the common sense of one of skill in the art.

28. I understand that secondary indicia of non-obviousness may include (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. I understand that evidence of secondary indicia of non-obviousness, if available, should be considered as part of the obviousness analysis.

29. I also understand that there must be a relationship between any such secondary considerations and the invention. I further understand that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.

30. In sum, my understanding is that prior art teachings are properly combined where a person of ordinary skill in the art having the understanding and knowledge reflected in the prior art and motivated by the general problem facing the inventor, would have been led to make the combination of elements recited in the

claims. Under this analysis, the prior art references themselves, or any need or problem known in the field of endeavor at the time of the invention, can provide a reason for combining the elements of multiple prior art references in the claimed manner.

31. I understand that obviousness in an *inter partes* review must be shown by a preponderance of the evidence.

C. *My Understanding of Claim Construction*

32. I understand that, during an *inter partes* review, claims are to be given their broadest reasonable construction in light of the specification as would be read by a person of ordinary skill in the relevant art at the time of invention. For the purpose of this proceeding, I have used Oct. 30, 2007 as the approximate time of the invention.¹

¹ The '688 Patent claims priority to Provisional Patent Application No. 61/001,207, filed Oct. 30, 2007. I have been asked to use this as the invention date without acquiescence as to whether or not the '688 Patent is actually entitled to this priority date.

V. Level of Ordinary Skill in the Art

33. A person of ordinary skill in the art at or before the time of the invention of the ‘688 Patent² (a “POSITA”) would have had a Master’s of Science Degree in an academic area emphasizing Electrical Engineering, Physics, Computer Engineering, or an equivalent field (or a similar technical Master’s Degree, or higher degree) with a concentration in wireless communication and networking systems. Alternatively, a POSITA would have had a Bachelor’s degree (or higher) in an academic area emphasizing Electrical Engineering, Physics, Computer Engineering, or an equivalent field as well as at least 2 years of academic or industry experience in wireless communications and networking systems. A POSITA would also have had experience with the wireless Standard Setting Organizations such as European Telecommunications Standards Institute (ETSI), Institute of Electrical and Electronics Engineers (IEEE), and 3rd Generation Partnership Project (3GPP), and would have been familiar with relevant standards and draft standards directed to wireless communications. Additional education in a relevant field, such as electrical engineering or physics, or industry experience may compensate for a deficit in one of the other

² Unless noted otherwise, references herein to what would have been known or understood by a POSITA refers to the knowledge of a POSITA at or before the time of the purported invention of the ‘688 Patent.

aspects of the requirements stated above. I am familiar with the knowledge and capabilities of one of ordinary skill in these areas based on my experience working with industry, with undergraduate and post-graduate students, with colleagues from academia, and with engineers practicing in industry.

VI. Overview of the Technology

A. *Wireless communication system*

34. Wireless communication systems, particularly, cellular communication systems, include base stations (BSs) that provide wireless connectivity to one or more cells or sectors within the wireless communication system. User equipment (UE) (e.g., mobile telephones) located in each cell may access the wireless communications system by establishing a wireless communication link, often referred to as an air interface, with the base station associated with the cell or sector. Each BS typically provides wireless connectivity to more than one UE. Consequently, air interface resources are shared between the multiple UEs. The user equipment may also be referred to as access terminal, mobile station, mobile unit, subscriber station, and the like. *See e.g., HUAWEI-1011, [0004] [0005].*

35. Wireless communication links include uplink (UL) channels for transmitting information from the UE to the BS and downlink (DL) channels for transmitting information from the BS to UE. The UL and DL channel can include data

channels for transmitting data traffic and signaling or control channels to carry control information that helps decode the data channels. The UL and DL channels may be shared by multiple UEs or dedicated to one UE at a time. For example, channels can be defined using different time slots (e.g., Time Division Multiple Access (TDMA)), frequencies (e.g., Frequency Division Multiple Access (FDMA)), code sequences (e.g., Code Division Multiple Access (CDMA)), orthogonal subcarrier frequencies or tones in a carrier frequency band (e.g., Orthogonal Frequency Division Multiplexing (OFDM)), or combinations thereof. *See e.g., HUAWEI-1011, [0005].*

B. *Long-Term Evolution (LTE)*

36. For next generation wireless systems like the Universal Mobile Telecommunication System (UMTS), Long-Term Evolution (LTE) is a wireless system standard also known as Evolved Universal Terrestrial Radio Access (E-UTRA). LTE specifies transmission requirements and design specifications described in documents from an organization named “3rd Generation Partnership Project” (3GPP). *See e.g., HUAWEI-1020, 3:17-22.* 3GPP develops technical specifications for its Organizational Partners that in-turn adopt those specifications in to their regional standards. *See HUAWEI-1024; HUAWEI-1021, 1:18-59.* The development of specifications by 3GPP is an ongoing, collaborative effort involving hundreds of engineers from many companies. *See id.; HUAWEI-1022.* Members of the various 3GPP

working groups submit written contributions and discussion documents before, during, and after scheduled working group meetings. *See* HUAWEI-1022. 3GPP stores these documents electronically and retains them on 3GPP's public FTP server indefinitely. *See id.*

37. Particularly, LTE systems use Orthogonal Frequency Division Multiple Access (OFDMA) technology in the DL, and Single Carrier Frequency Division Multiple Access (SC-FDMA) technology in the UL because, compared to the OFDMA, SC-FDMA has a lower peak to average power ratio (PAPR) that is more desirable for the UE due to UE's PAPR constraints for UL transmission. *See* HUAWEI-1019, [0003]; HUAWEI-1011, [0007].

38. LTE defines physical UL control channel (PUCCH) for transmitting unscheduled UL control information. Three types of UL control information are typically transmitted over the PUCCH: (1) Acknowledgement and/or Non-Acknowledgement (ACK/NAK) messages, (2) Channel Quality Information (CQI) and (3) Scheduling Request (SR). *See e.g.*, HUAWEI-1011, [0008].

39. ACK/NAK messages may be transmitted over the PUCCH by a UE in response to receiving DL data from a BS. An ACK message is transmitted to acknowledge successful reception of each downlink block of data and a NACK message is sent if a failure is detected during the reception. The NACK messages may

trigger a retransmission of the unsuccessfully received data. *See e.g.*, HUAWEI-1011, [0008].

40. CQI indicates the quality of signals received on the DL. CQI is transmitted over the PUCCH at predetermined periodic intervals. *See e.g.*, HUAWEI-1011, [0008].

41. UEs may also transmit scheduling requests (SRs) over the PUCCH in order to request resources in the scheduled data channels such as physical uplink shared channel (PUSCH). For example, a UE may transmit an SR when its transmit buffer is filled and has information, such as a data burst, to transmit over the UL channel. The UE transmits an SR on PUCCH to request access to the UL channel. The UE then waits to transmit information over the UL channel until after receiving an access grant from the BS. The access grant typically indicates the resources, such as a timeslot, a channel code, a frequency or tone, and the like, that have been allocated to the UE to transmit the information on an UL data channel (e.g., PUSCH). *See e.g.*, HUAWEI-1011, [0006] [0008].

VII. Brief Overview of the ‘688 Patent

42. The ‘688 Patent is entitled “Providing improved scheduling request signaling with ACK/NACK or CQI.” It relates to wireless communication systems, particularly, LTE (long term evolution of UTRAN (E-UTRAN) systems. *See* HUAWEI-1001, 1:19-23 and 47.

43. Particularly, the ‘688 Patent concerns multiplexing (i.e., simultaneously transmitting) uplink (UL) control signals. HUAWEI-1001, 4:3-5. More specifically, the ‘688 Patent focuses on cases where a scheduling request (SR) is transmitted simultaneously with an acknowledgement (e.g., ACK/NACK) or channel quality indicator (CQI). HUAWEI-1001, 4:3-5. FIG. 5 (reproduced with annotation below) of the ‘688 Patent shows four cases of transmission of one or more of the SR, ACK/NACK, and CQI control signals and identifies resources used for respective transmissions in the four cases:

(1) Only ACK/NACK; no SR or CQI => Use ACK/NACK resources:

See box 54: If there is an ACK/NACK (w/o CQI), the ACK/NACK is transmitted using ACK/NACK resources and the SR resources are unused. HUAWEI-1001 at 6:28-30.

(2) CQI (with or without ACK/NACK); no SR => Use CQI resources:

See box 56: If there is a CQI (with or without ACK/NACK), the CQI (or CQI+ACK/NACK) is transmitted using CQI resources, CQI PUCCH, and the SR resources (and ACK/NACK PUCCH) are unused. HUAWEI-1001 at 6:30-33.

(3) Only SR; no ACK/NACK => Use SR resources:

See box 60: If ACK/NACK is not present, then the SR is transmitted using the SR resources and the additional resource which may be data-non-associated (DNA) resources, such as ACK/NACK PUCCH and CQI PUCCH are unused. No

CQI is transmitted, regardless of whether or not it is present. HUAWEI-1001 at 6:36-41.

(4) Both SR and ACK/NACK => Use SR resources:

See box 62: If ACK/NACK is present, then the ACK/NACK is transmitted using the SR resources and the DNA resources, such as ACK/NACK PUCCH and CQI PUCCH are unused. No CQI is transmitted, regardless of whether or not it is present. HUAWEI-1001 at 6:41-45.

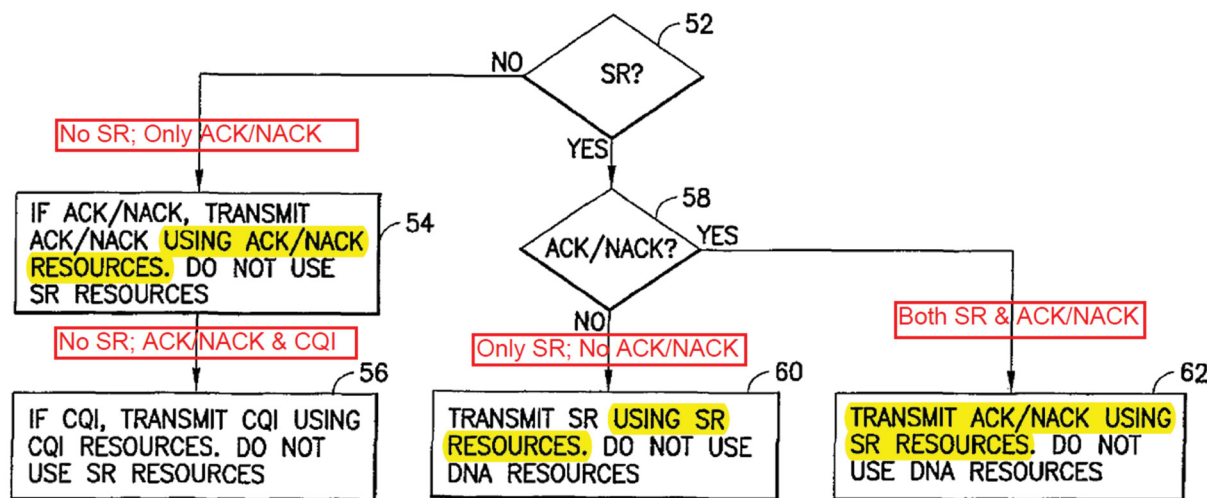


FIG.5

FIG. 5 of the '688 Patent (annotated)

44. Claims 1-24, 37-40, 42-48 (“the Challenged Claims”) are at issue in this proceeding. The independent claims are directed to the implementation as shown in boxes 58, 60 and 62 of FIG. 5. For example, claim 1 recites “for a case where there is also a scheduling request to be sent [together with an acknowledgment],

combining the acknowledgment with the scheduling request on a scheduling resource.” HUAWEI-1001, claim 1.

VIII. Admitted Prior Art Teachings of the ‘688 Patent

45. The ‘688 Patent in its Background Section acknowledges extensive and related teachings (such as the bullet points below) that had been known in the prior art and agreed in the standardization of LTE. HUAWEI-1001, 2:1-2.

A. *LTE means E-UTRAN:*

46. LTE stands for “long term evolution of UTRAN (E-UTRAN).” That is, LTE is another name of E-UTRAN. 3GPP (third generation partnership project) is the organization that “has been working on the standardization of LTE (E-UTRAN).” *See* HUAWEI-1001, 2:1-2; 1:46-47 and 65. Moreover, I believe a POSITA would have readily understood that LTE refers to E-UTRAN, and vice versa, because this is common knowledge well known in the art. *See e.g.*, ¶ 36 of this Declaration.

B. *UE transmits data-non-associated UL control signals (including acknowledgement) on a physical uplink control channel (PUCCH):*

47. The ‘688 Patent admits that “data-non-associated control signals (e.g., ACK/NACK, periodic CQI) are transmitted on the PUCCH.” HUAWEI-1001 at 2:1-3. The data-non-associated control signals refer to control signals, such as acknowledgement/negative acknowledgement (ACK/NACK) and/or channel quality indicator (CQI), transmitted without UL data. HUAWEI-1001, 4:3-10. *See also*

“CQI and ACK/NACK for downlink data transmissions are called uplink data-non-associated control information.” HUAWEI-1019, [0004]. It had been known that “where the UE has no data to transmit (i.e., on the UL), the ACK/NACK is signaled on the PUCCH.” HUAWEI-1001 at 2:42-43.

C. Acknowledgment data (e.g., ACK/NACK signals) includes a modulated BPSK or QPSK sequence:

48. The ‘688 Patent admits that “Furthermore, it has been decided that: (a) **ACK/NACK (only) signals are transmitted utilizing modulated CAZAC₁ sequences (coherent).** BPSK is used for 1-bit ACK/NACK and **QPSK for 2-bit ACK/NACK.**”³ HUAWEI-1001 at 2:4-7.

D. Acknowledgment data (e.g., ACK/NACK signals) are transmitted with reference signals, where the reference signals are unmodulated sequences:

49. The ‘688 Patent admits that the ACK/NACK signals are transmitted based on *coherent* demodulation. See HUAWEI-1001 at 2:5-6. *Coherent* demodulation/detection of modulated data had been well known to a POSITA that it relies on reference signals for performing the detection of the data. See, for example, the Teder reference, which is in the same field of art as the ‘688 Patent and relates to transmitting uplink signals in a wireless communication system (HUAWEI-1018,

³ Bolded text represents emphases added by me in each citation, unless otherwise specified.

Abstract), discloses that “[t]echniques for both **coherent** and non-coherent **detection are well known**, but their usage depends on **the availability of reference signals**.” HUAWEI-1018, 1:43-47. Indeed, coherent detection necessitates a reference signal because the reference signal is used to estimate channel, especially the phase information, “to resolve ambiguities in received signals.” *See e.g.*, HUAWEI-1018, 1:25-27 and 36-41. **Without a reference signal, “non-coherent detection must be used.”** HUAWEI-1018, 1:47-48.

50. The RS are *known* sequences to the intended receiver and are transmitted with the *unknown data* encoded in the modulated sequence. *See* “The **reference signal can be a dedicated pilot signal or simply pilot symbols known to the receiver which are interspersed with the data signal**.” HUAWEI-1018, 1:48-50. In other words, unlike unknown data encoded in the modulated sequence (e.g., the ACK/NACK information encoded in the BPSK or QPSK *modulated sequences* in this case), the RS are unmodulated sequence known by the intended receiver, based on which the intended receiver performs channel estimation and in turn detect the unknown ACK/NACK information encoded in the modulated sequence.

51. In fact, in the Background section, the ‘688 Patent further discloses the RS (i.e., pilot) are transmitted together with the *data* encoded in the modulated sequence: “[b]lock-wise spreading with **SF=3/SF=4 (pilot/data) is applied for the modulated CAZAC₁ sequences**.” HUAWEI-1001 at 2:7-9. In other words, here the

coherent demodulation of the acknowledgement data uses a specific pilot/data ratio: **3 reference signals/pilots** for 4 data sequences. The acknowledgement data sequences are *modulated* CAZAC sequences whereas the “same sequences [i.e., **un-modulated** true CAZAC sequences or “computer searched Zero-Autocorrelation (ZAC) sequences”] are applied as reference signals.” *Id.* 2:10-11.

52. Moreover, the Applicant admitted during the prosecution history of the '877 Patent, the parent case of the '866 Patent, that the reference signals are an unmodulated sequence: “according to Papasakellariou, [‘]Referring to FIG. 3, the CAZAC sequence 310 is generated through one of the previously described methods (modulated for transmission of CQI bits, **un-modulated for RS transmission**),[‘] (paragraph [0018]).” HUAWEI-1028 at 344. Indeed, the cited Papasakellariou reference discloses that “if the transmitted CAZAC-based sequence illustrated in FIG. 3 or FIG. 5 is **not be modulated by any information (data or control), it can then serve as the [reference signal, RS].**” HUAWEI-1012, [0026].

IX. Claim Construction

53. I have been informed that claim terminology must be given the broadest reasonable interpretation during an IPR proceeding. I have been informed that this means the claims should be interpreted as broadly as their terms reasonably allow, but that such interpretation should not be inconsistent with the patent’s specification and with usage of the terms by one of ordinary skill in the art. Counsel has also

informed me that this may yield interpretations that are broader than the interpretation applied during a District Court proceeding.

54. I have been informed that it would be useful to provide some guidance in this proceeding with respect to certain terms, and have been asked to consider the terms below and corresponding constructions. As part of that, for each term addressed below, I considered each term's context within the claim, each term's use within the specification, and my understanding of how one of ordinary skill in the art would understand the term around the time of the purported invention.

A. *a sequence that is unmodulated via a modulation scheme used for the acknowledgement data (claims 1, 7, 10, 14, 21, 25, 29, 32 and 37)*

55. I have considered whether a broadest reasonable interpretation (BRI) of the phrase “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” would be broad enough to encompass “reference signals.” I believe that it would, because such an interpretation is consistent with the ‘688 Patent’s Specification, the prosecution history of the ‘688 patent, and the understanding one of ordinary skill in the art would ascribe to this term when looking for the broadest reasonable construction.

56. First, claim 7, depending from claim 1, recites that “where the physical uplink control channel comprises *an unmodulated sequence*,” and further makes it plain that “*the unmodulated sequence comprises reference signals.*” HUAWEI-1001, claim 7. The broadest reasonable interpretation of the phrase “a sequence that

is unmodulated via a modulation scheme used for the acknowledgement data” is broad enough to encompass “an unmodulated sequence,” (i.e., a sequence that is unmodulated [via any modulation scheme], not just “unmodulated via a modulation scheme used for the acknowledgement data,”). As claim 7 makes clear that the “unmodulated sequence” encompasses “reference signals,” it follows that “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” is broad enough to encompass “references signals,” which is further evident from the Specification as discussed above. HUAWEI-1001, claims 1 and 7. *See also* claim 21.

57. The ‘688 Patent Specification support the above interpretation of the phrase of “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data.” At the outset, the ‘688 Patent Specification fails to specifically define this phrase. In fact, the term “**unmodulated**” is only and repeatedly used in the phrase “an **unmodulated sequence 1**” and contrasted with “**BPSK/QPSK-modulated sequence 2**” in the context of transmitting ACK/NACK. *See e.g.*, “The ACK/NACK can be transmitted similarly to when it is transmitted on its own resource (e.g., **unmodulated sequence 1, BPSK/QPSK-modulated sequence 2**).” HUAWEI-1001, 5:65-67. In other words, the ACK/NACK transmission includes “(e.g., **unmodulated sequence 1,**

BPSK/QPSK-modulated sequence 2)” when it is transmitted on ACK/NACK resource. Indeed, the “**unmodulated sequence 1**” appears to be the ‘688 Patent Specification’s preferred, if not only, embodiment of “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” as recited in claim 1. *See id.* In other words, in view of the ‘688 Patent Specification, the “unmodulated sequence” is an example of “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data.” *See id.*

58. Recall that the ‘688 Patent admits that, when ACK/NACK signals are transmitted, **the ACK/NACK signals are BPSK or QPSK modulated sequences**, transmitted together with **pilots** (also known as **reference signals**). HUAWEI-1001, 2:5-7. Correlating the above disclosures of the ‘688 Patent, a POSITA would have readily recognized that the “BPSK/QPSK-modulated sequence 2” refers to the ACK/NACK data, whereas the “unmodulated sequence 1” refers to the reference signals. *See* HUAWEI-1001, 5:65-67. Moreover, such a recognition is further corroborated by the ‘688 Patent’s disclosure that “**ACK/NACK (only) signals are transmitted utilizing modulated CAZAC₁ sequences**,” whereas “the same [*unmodulated*, true CAZAC or computer searched Zero-Autocorrelation (ZAC)] sequences are applied as **reference signals**.” HUAWEI-1001, 2: 5-7 and 10-12. In other words, “the reference signals” are encompassed by the “unmodulated sequence,” which is

further encompassed by “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” according to the ‘688 Patent Specification.

59. Furthermore, a POSITA would readily understand that the reference signals are *unmodulated* sequences given that the reference signals are used as pilots for coherent demodulation of the ACK/NACK data. HUAWEI-1001, 2:5-7. The notion of using reference signals (RS) that are *unmodulated* with information *unknown* to an intended receiver for coherent demodulation of other information (e.g., ACK/NACK information (i.e., whether it is an ACK or a NACK)) had been well-known to a POSITA. In other words, the RS are known sequences to the intended receiver so that the intended receiver can perform channel estimation based on the known RS, and then use the estimated channel to coherently demodulate the unknown data encoded in the modulated sequence (e.g., the ACK/NACK information encoded in the BPSK or QPSK *modulated sequences* in this case). For example, the Teder reference, which is in the same field of art as the ‘688 Patent and relates to transmitting uplink signals in a wireless communication system (HUAWEI-1018, Abstract), discloses that “[t]echniques for both **coherent** and non-coherent **detection are well known**... if a reference signal exists, coherent detection is the typical choice... **The reference can be** a dedicated pilot signal or simply pilot symbols **known to the receiver** which are interspersed with the data signal.” HUAWEI-1018, 1:36-50.

60. Moreover, the prosecution history of the ‘688 Patent further makes it clear the “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” comprises reference signals” because, during the prosecution of the ‘877 Patent, the parent case of the ’866 Patent, the Applicant states that **“an unmodulated sequence such as a demodulation reference signal sequence** for Format 1/1a/1b [is transmitted] in addition to an acknowledgment.” HUAWEI-1028, p.341. Additionally, the Applicant admitted that the reference signals are an unmodulated sequence: “according to Papasakellariou, [‘]Referring to FIG. 3, the CAZAC sequence 310 is generated through one of the previously described methods (modulated for transmission of CQI bits, **un-modulated for RS transmission**),[‘] (paragraph [0018]).” HUAWEI-1028, p. 344. Indeed, the cited Papasakellariou reference discloses that “if the transmitted CAZAC-based sequence illustrated in FIG. 3 or FIG. 5 is **not be modulated by any information (data or control), it can then serve as the [reference signal, RS].**” HUAWEI-1012, [0026]. Accordingly, given that the ‘688 Patent Specification discloses the “unmodulated sequence” as an example of “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data,” and the “unmodulated sequence” encompasses “reference signals,” “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” is broad enough to encompasses “reference signals.”

61. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

62. For at least the above reasons, I believe the broadest reasonable construction of the term “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” should encompass “reference signals.”

X. KwakProv812 supports at least one claim of KwakPat883

63. At a high level, KwakPat883 discloses transmitting uplink control signals in a wireless communication system using different resources (e.g., a ACK/NACK resource or a scheduling request (SR) resource). HUAWEI-1005, Abstract. Claim 1 of KwakPat883 recites the following:

A method of transmitting uplink control signals in a wireless communication system using at least one subframe comprising two slots, each slot including a plurality of symbols, the wireless communication system configured to transmit a scheduling request (SR) via a preassigned SR physical uplink control channel (PUCCH) resource and to transmit a ACK/NACK via a preassigned ACK/NACK physical uplink control channel (PUCCH) resource, the method comprising:

determining whether or not an ACK/NACK and a SR are to be transmitted in a subframe; and

transmitting the ACK/NACK and the SR in the subframe via the preassigned SR PUCCH resource if the step of determining indicates that the ACK/NACK and the SR are to be transmitted in the subframe.

HUAWEI-1005, claim 1.

64. Although not in verbatim, KwakProv812, the provisional application of KwakPat883, discloses every feature of Claim 1 of KwakPat883. I break down claim 1 into multiple features and discuss KwakProv812's support for each feature in the following.

A. A method of transmitting uplink control signals in a wireless communication system

65. KwakProv812 discloses, for example, “a **transmission method** which can support both the **control signal** and the SR,” HUAWEI-1007, 48:3-4. FIG.2 (reproduced below) shows control signals are transmitted by a user equipment (UE) on “**UL Control Channel**,” HUAWEI-1007, 49:17-20) *in a wireless communication system* (e.g., “a **broadband communication system**...to maximize efficiency in limited **wireless resources**.” HUAWEI-1007, 48:22-23).

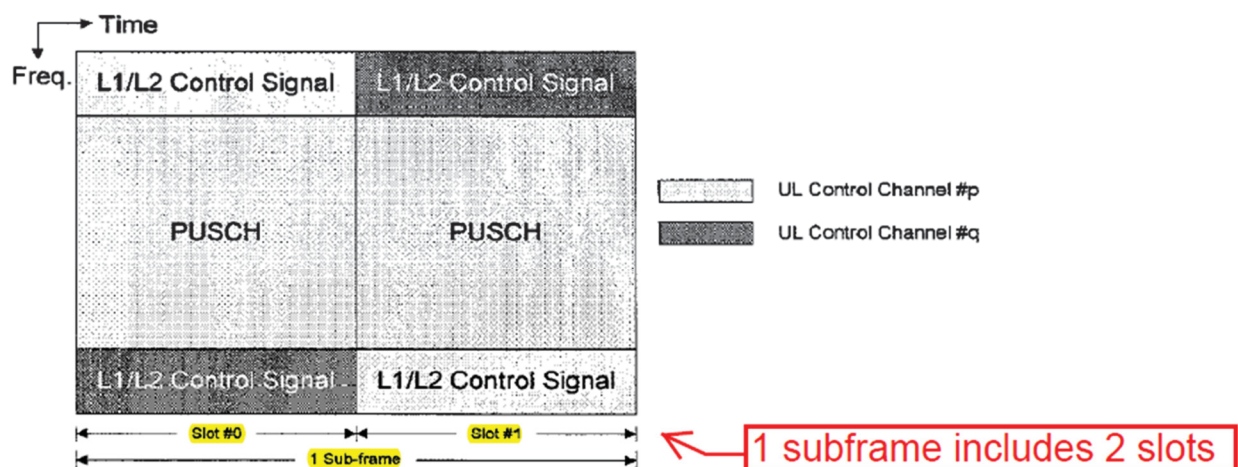


FIG. 2. Transmission of the control signal when there is no data

66. KwakProv812, FIG.2 (annotated)

B. at least one subframe comprising two slots

67. As shown in above annotated FIG.2, KwakProv812 shows “Transmission of the control signal” using at least one subframe comprising two slots, Slot # 0 and Slot #1. KwakProv812 further discloses that FIG. 3 shows a control channel structure of one slot, and hence in one sub-frame, for transmitting coherent ACK/NACK transmission in LTE. HUAWEI-1007, 50:3-5, p. 50, FIG.3, Title. *See also:*

Further, **FIG. 3 shows a control channel structure for** transmitting coherent **ACK/NACK** transmission. In the drawing, the transmission structure **of one slot** is shown, and a frequency diversity gain is obtained as one signal is repetitively transmitted through slot based frequency hopping **in one sub-frame** as shown in FIG. 2. HUAWEI-1007, 50:3-6.

C. each slot including a plurality of symbols

68. FIG. 3 (reproduced below with annotations) also shows that each slot includes a plurality of (i.e.,7) symbols and KwakProv812 discloses “**transmitting an SR signal in a 2D spreading channel structure ... like an LTE ACK/NACK channel**” as shown in FIG.3, HUAWEI-1007, 51:19-20. Specifically, KwakProv812 goes on to disclose, the SR channel, like the ACK/NACK channel shown in FIG. 4 that includes one slot further includes **4 OFDM symbols** for carrying SR information and **3 OFDM symbols** for reference signals. *See e.g.*, “the SR channel is configured

by respectively allocating the orthogonal codes having a **length of 4** to OFDM symbols for carrying SR information and the orthogonal codes having a **length of 3** [symbols] to a section used as RS,” HUAWEI-1007, 56:1-5.

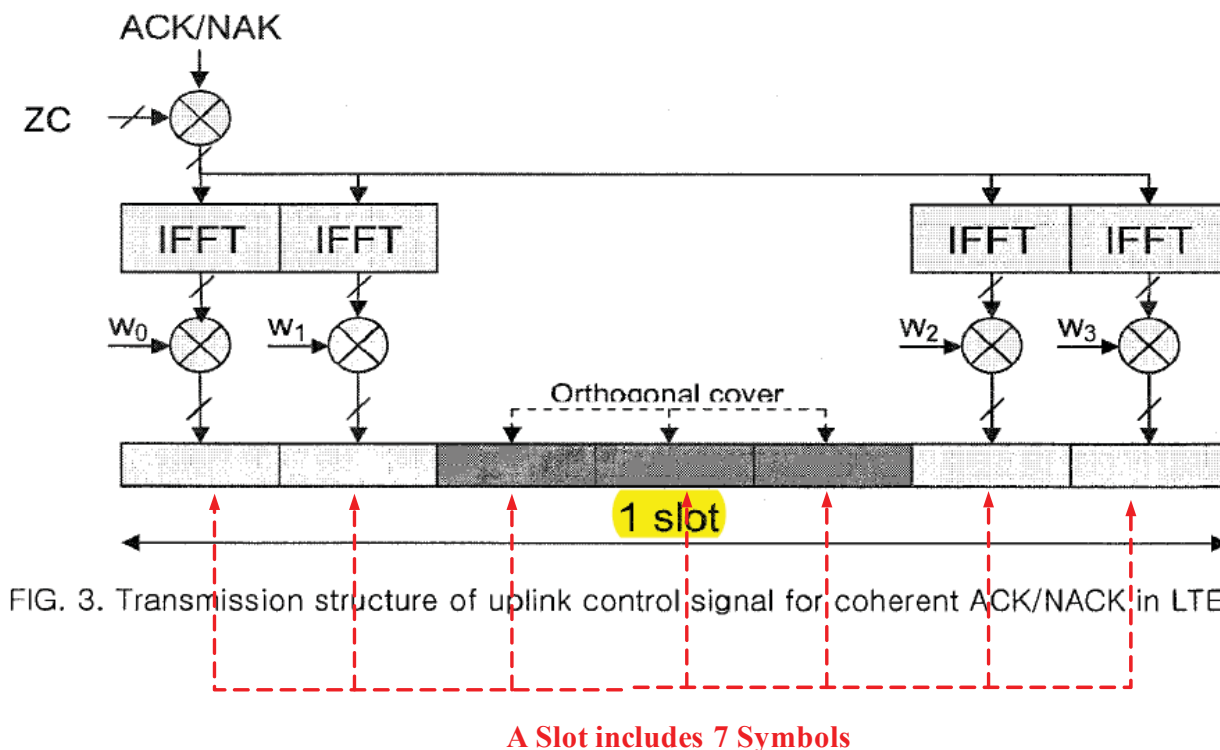


FIG. 3. Transmission structure of uplink control signal for coherent ACK/NACK in LTE

69. KwakProv812, FIG.3 (annotated)

D. *the wireless communication system configured to transmit a scheduling request (SR) via a preassigned SR physical uplink control channel (PUCCH) resource and to transmit a ACK/NACK via a pre-assigned ACK/NACK physical uplink control channel (PUCCH) resource*

70. KwakProv812 discloses the wireless communication system configured to transmit a scheduling request (SR) via a preassigned SR uplink control channel resource and to transmit a ACK/NACK via a preassigned ACK/NACK uplink

control channel resource, and the uplink control channel resource is physical uplink control channel (PUCCH) resource:

1. preassigned SR uplink control channel resource and preassigned SR ACK/NACK uplink control channel resource

71. KwakProv812 discloses a *preassigned* SR uplink control channel and a *preassigned* ACK/NACK uplink control channel by disclosing that “**previously-allocated control channels** have been utilized to **transmit the control signals**. Specifically, a transmission structure for an **uplink control signal** in long term evolution (LTE)” is described as an example. HUAWEI-1007, 49:2-4. KwakProv812 explains that preassigned control channels are *preassigned control channel resources*: “When **the control signal is transmitted within a previously allocated band** as shown in FIG. 2, it has been considered that the **spreads in the time domain as well as the frequency domain** are all used to maximize UE capability for transmitting a small amount of data.” HUAWEI-1007, 50:1-3. “It is possible to **configure** a dedicated **SR channel by allocating certain time/frequency/code resources**.” HUAWEI-1007, 50:9-10. For example, KwakProv812 further discloses “**configuring an SR channel and an ACK/NACK channel through the code allocation**,” that is, through allocation of resources. HUAWEI-1007, 52:13-14

72. KwakProv812 references the SR channel as *preassigned SR uplink control channel resource* and that it teaches transmission of SR on such a previously allocated (which is a synonym for preassigned, *see* HUAWEI-1025) channel: “when

the user equipment (UE) **transmits a scheduling request** for transmitting the uplink data[, i]t is possible to configure **a dedicated SR channel** by allocating certain time/frequency/code resources,” HUAWEI-1007, 50:9-10; “the **SR ... can be transmitted** through the **previously allocated SR channel**.” HUAWEI-1007, 59:16-18.

73. Similarly, KwakProv812 references the ACK/NACK channel as *pre-assigned ACK/NACK uplink control channel resource* and that it teaches transmission of ACK/NACK on such a previously allocated channel: “The **control channel region previously allocated for transmitting** the above time-frequency spreading **ACK/NACK signal**,” HUAWEI-1007, 50:7-8; “**the ACK/NACK information** undergoes the coherent modulation/demodulation **through the previously allocated ACK/NACK channels**.” HUAWEI-1007, 59:23-24. *See also* FIG. 3 shows “**Transmission structure of uplink control signal for coherent ACK/NACK in LTE**.”

2. physical uplink control channel (PUCCH)

74. The SR uplink control channel and ACK/NACK uplink control channel resources are *physical* uplink control channel (PUCCH) resources. It had been known that LTE defines PUCCH for transmitting unscheduled UL control information, including (1) ACK/NAK messages, (2) Channel Quality Information (CQI) and (3) Scheduling Request (SR). *See e.g.*, HUAWEI-1011, [0008]. UE transmits uplink ACK/NACK on a **PUCCH (physical uplink control channel)** when the UE has **no UL data to transmit**, whereas UE transmits uplink acknowledgment on a

PUSCH (physical uplink shared channel) when the UE **has UL data to transmit**. This is prior art knowledge that the ‘688 Patent candidly admits in the Background: “where the **UE has no data to transmit** (i.e., on the UL), the ACK/NACK is signaled on the **PUCCH**. When the **UE has UL data to transmit**, the ACK/NACK is signaled on the **PUSCH**.” HUAWEI-1001 at 2: 42-46; 1:51-52. *See also* tutorial background knowledge of LTE discussed in ¶¶ 38-41 of this Declaration.

75. Here, KwakProv812 also discloses the preassigned SR uplink control channel and the preassigned ACK/NACK uplink control channel in a LTE system, (*see e.g.*, HUAWEI-1007, 49:2-4) and **these uplink control channel are used when when the UE has no UL data to transmit**:

If there is **no data to be transmitted along with the control signal**, some of a system band [that] “is distinguished and allocated by FDM and **the user equipment** for transmitting only the control channel **transmits the [uplink] “control signal** by demodulating the control signal **to this allocated region** in the form of SCFDM (**refer to FIG.2**). In this allocated region, the method of transmitting the control signal may employ FDM or code division multiplexing (CDM) between the user equipments.

When **the control signal is transmitted within a previously allocated band as shown in FIG. 2**, it has been considered that the spreads in the time domain as well as the frequency domain are all used to maximize UE capability for transmitting a small amount of data. Further, FIG. 3 shows a control channel structure for transmitting coherent ACK/NACK transmission. In the drawing, the transmission structure of one slot is shown, and a frequency diversity gain is obtained as one signal is repetitively transmitted through slot based frequency hopping in one sub-frame as shown in FIG. 2.
HUAWEI-1007, 49:19-4:6.

76. Accordingly, the preassigned SR uplink control channel and the preassigned ACK/NACK uplink control channel are on **PUCCH (physical uplink control channel)**.

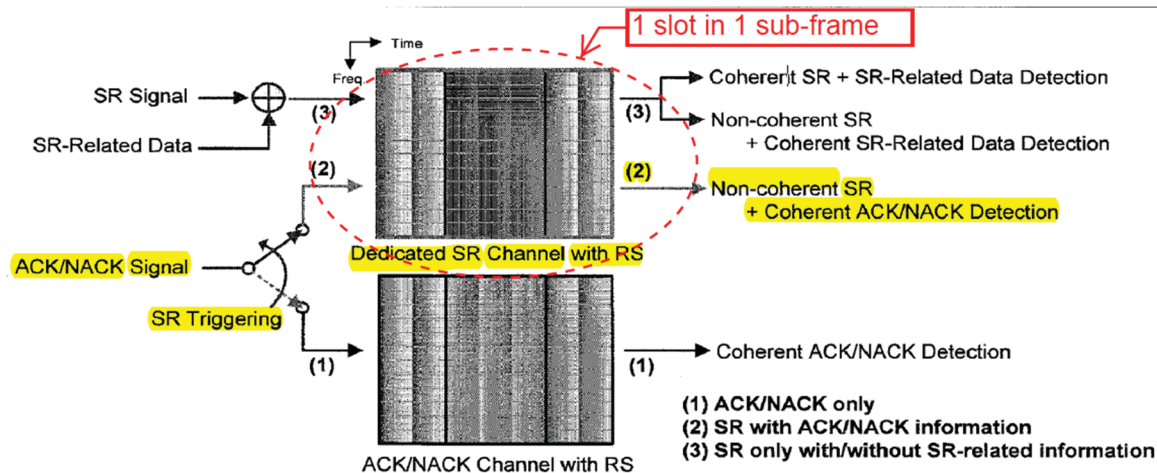
77. Additionally, FIG. 2 (reproduced above) shows the “**UL Control Channel**,” i.e., “this allocated region” for “L1/L2 control signal,” is distinguished from the data region denoted as “**PUSCH**” (i.e., **physical uplink shared channel**), which further corroborating KwakProv812’s disclosure of a **physical uplink control channel (PUCCH)**.

E. *determining whether or not an ACK/NACK and a SR are to be transmitted in a subframe*

78. KwakProv812 discloses *determining whether or not an ACK/NACK and a SR are to be transmitted in a subframe* by disclosing, e.g., determining “[i]f **the transmission of the ACK/NACK signal** is required **at the SR transmission** like (2) of FIG.7” HUAWEI-1007, 59:16-17. Moreover, FIG.7 (reproduced below with annotations) shows that the selection of path (1) or (2) is based on the determination of “SR Triggering,” that is, the determination of whether the SR is to be transmitted with the ACK/NACK will trigger different path selection of (1) or (2).

79. KwakProv812 discloses the ACK/NACK and the SR are to be transmitted in the subframe by disclosing that the SR channel is configured for “**transmission [of SR] simultaneous with** a certain control signal such as the **ACK/NACK signal**,” HUAWEI-1007, 52:17-20. Indeed, as shown in (2) of FIG.7,

both the ACK/NACK signal and SR are transmitted in the SR channel within one subframe: “like an LTE ACK/NACK channel” (as shown in (1) in FIG.7 and in FIG.3), the SR channel having 7 symbols is of one slot in one subframe. See HUAWEI-1007, 51:4, 6-7, 50:3-6, pp. 50&54, FIGS.2-4.



80. KwakProv812, FIG.7 (annotated)

F. transmitting the ACK/NACK and the SR in the subframe via the preassigned SR PUCCH resource if the step of determining indicates that the ACK/NACK and the SR are to be transmitted in the subframe

81. KwakProv812 discloses transmitting the ACK/NACK and the SR in the subframe via the preassigned SR PUCCH resource if the step of determining indicates that the ACK/NACK and the SR are to be transmitted in the subframe by disclosing, e.g., “[i]f the transmission of the ACK/NACK signal is required at the SR transmission like (2) of FIG.7, **both the SR and ACK/NACK can be transmitted through the previously allocated SR channel.**” HUAWEI-1007, 59:17-18. Also, FIG.7 shows, upon the determining that SR is to be transmitted together with the

ACK/NACK Signal at “SR Triggering,” the selection of path (2) is triggered where the SR and the ACK/NACK are to be transmitted simultaneously in the SR channel, which “like an LTE ACK/NACK channel” is “of one slot” “in the subframe.” See (1) in FIG.7 and in FIG.3, HUAWEI-1007, 51:4, 6-7, 50:3-6; FIGS.2-4.

82. Thus, for at least these reasons, claim 1 of KwakPat883 is fully supported by KwakProv812.

83. The only other independent claim 8 in KwakPat883 is a *mobile communication apparatus* claim recites:

8. A mobile communication apparatus configured to transmit uplink control signals in a wireless communication system using at least one subframe comprising two slots, each slot including a plurality of symbols, the wireless communication system configured to transmit a scheduling request (SR) via a preassigned SR physical uplink control channel (PUCCH) resource and to transmit a ACK/NACK via a preassigned ACK/NACK physical uplink control channel (PUCCH) resource, the mobile communication apparatus comprising:

a transmitter configured to
determine whether or not an ACK/NACK and a SR are to be transmitted in a subframe, and
transmit the ACK/NACK and the SR in the subframe via the preassigned SR PUCCH resource if the transmitter determines that the ACK/NACK and the SR are to be transmitted in the subframe.

HUAWEI-1005, claim 8.

84. Claim 8 recites similar, if not identical, features of claim 1 and thus is also supported at least by the disclosure identified above and by KwakProv812’s disclosure of a user equipment (UE) for performing the transmission method of claim 1. It has been well-known in the art that a UE is a mobile communication

apparatus, especially in the context of LTE, and a UE includes a transmitter such that “the user equipment (UE) transmits a scheduling request” and for performing the transmission method of claim 1 as disclosed by KwakProv812. *See e.g.*, HUAWEI-1007, 50:8-9.

XI. Application of KwakPat883 to the Challenged Claims of the ‘688 Patent

85. Note that KwakPat883’s claim 1 recites substantially the same features as claim 1 of the ‘688 Patent. *See* HUAWEI-1001, claim 1; HUAWEI-1005, claim 1. KwakPat883 discloses and KwakProv812 supports each and every feature of KwakPat883’s claim 1. *See* discussion of KwakProv812’s support for KwakPat883’s claim 1 in Section X. Accordingly, KwakPat883 discloses at least each feature of the ‘688 Patent’s claim 1. *See id.* In the following, KwakPat883’s disclosures of the Challenged Claims of the ‘688 Patent are discussed on a claim element basis. For each element of the Challenged Claims that is disclosed by KwakPat883’s Claim 1, the corresponding support from KwakProv812 as discussed in Section X is incorporated by reference as if fully sets forth in connection with the corresponding element.

A. [1A]: “*A method comprising*”

86. KwakPat883 discloses “a *method* of transmitting a plurality of multiplexed uplink control signals.” HUAWEI-1005, 2:25-26.

87. KwakProv812 discloses “**methods** for transmitting additional information ... if a scheduling request (SR) is made through time or frequency spreading channels for a control signal.” HUAWEI-1007, 48:6-8.

B. [1B] “determining that an acknowledgment is to be sent on a physical uplink control channel,”

88. KwakPat883 discloses determining that an acknowledgment is to be sent: “[t]ransmission of the **ACK/NACK signal is predetermined** according to transmission of downlink data.” HUAWEI-1005, 12:20-21. KwakPat883 discloses the acknowledgment is to be sent on a physical uplink control channel (PUCCH): “preparing a ACK/NACK resource for **transmitting the ACK/NACK signal** for HARQ of downlink data **on an uplink control channel**,” HUAWEI-1005, Abstract, where “[a]n **uplink control channel** assigned to the control region is referred to as a **physical uplink control channel (PUCCH)**,” HUAWEI-1005, 5:41-43. FIG.4 shows the control region that “is generally assigned to a control channel.” *Id.*

89. KwakProv812 supports the disclosure of determining that an acknowledgment is to be sent: “[i]f the **transmission of the ACK/NACK signal** is required at the SR transmission like (2) of FIG.7, both the SR and **ACK/NACK can be transmitted** through the previously allocated SR channel.” HUAWEI-1007, 59:16-18.

90. KwakProv812 supports that an acknowledgment is to be sent on a PUCCH (physical uplink control channel) by at least FIG.3, entitled “Transmission structure of **uplink control signal for coherent ACK/NACK** in LTE,” that “shows

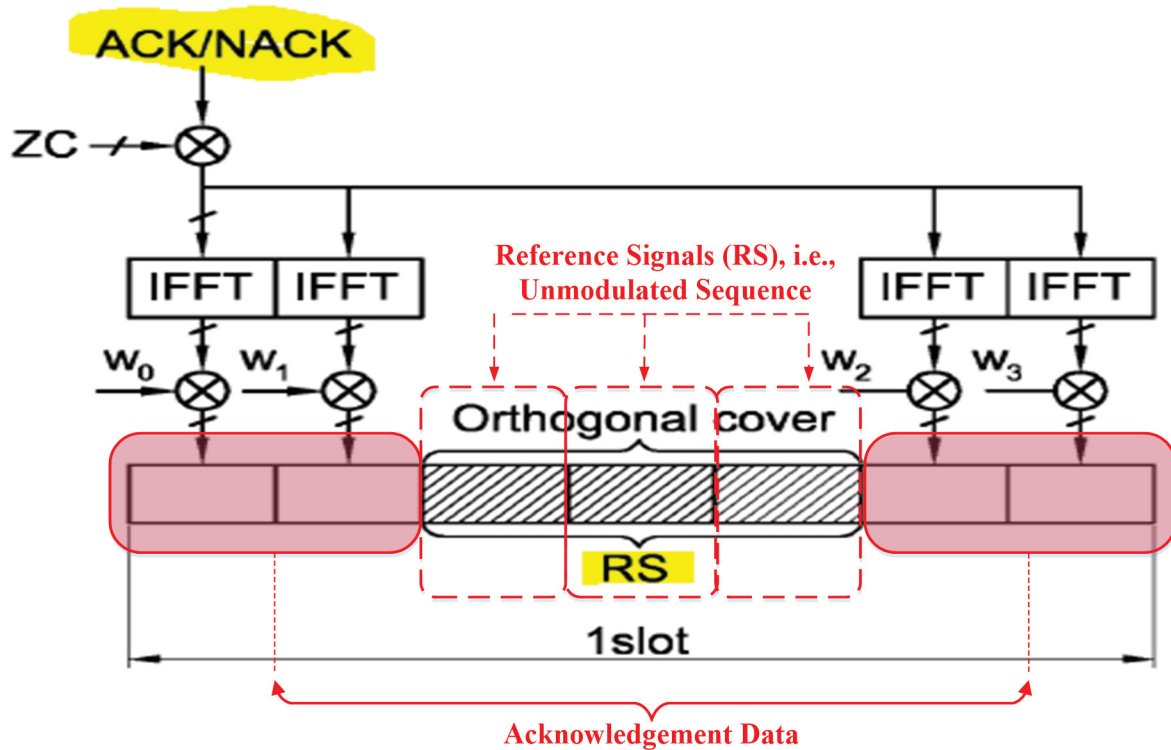
a control channel structure for transmitting **coherent ACK/NACK transmission.**” HUAWEI-1007, 50:3-4. *See also* KwakProv812’s disclosure that the uplink control channel (e.g., the ACK/NACK channel) is on a PUCCH in ¶¶ 74-77 of this Declaration.

C. [1C] “where transmission of the acknowledgement on the physical uplink control channel comprises in addition to the acknowledgement data, a sequence that is unmodulated via a modulation scheme used for the acknowledgement data;”

91. KwakPat883 discloses this element because “a sequence that is unmodulated via a modulation scheme used for the acknowledgment data” encompasses “an unmodulated sequence,” and the “unmodulated sequence” further encompasses reference signals (RS) (*see* Section IX of this Declaration). KwakPat883 discloses that transmission of the acknowledgement comprises reference signals in addition to the acknowledgement data (i.e., ACK/NACK signal).

92. Specifically, FIG. 5 [reproduced below with annotations] shows transmission of the acknowledgement: “FIG. 5 shows a structure of an ACK/NACK channel[,] a control channel through which an ACK/NACK signal is transmitted.” HUAWEI-1005, 6:13-15. “Referring to FIG. 5, among 7 OFDM symbols included in one slot, **a reference signal (RS) is carried on three consecutive OFDM symbols in the middle portion of the slot and the ACK/NACK signal is carried on the remaining four OFDM symbols.**” HUAWEI-1005, 6:19-23.

FIG. 5



93. KwakPat883, FIG.5 (annotated)

94. KwakProv812 supports KwakPat883's disclosure by showing in FIG.3 (reproduced below with annotations) that transmission of the acknowledgement that includes ACK/NACK data and reference signals: "the **existing channel for transmitting the ACK/NACK control signal...**, the **control channel** is configured by 2D spreading using ZC codes in the frequency domain and orthogonal codes having a **length of 4** (for short CP) **for the ACK/NACK data** or **orthogonal codes** having a **length of 3** for RS in the time domain." HUAWEI-1007, 52:23-26.

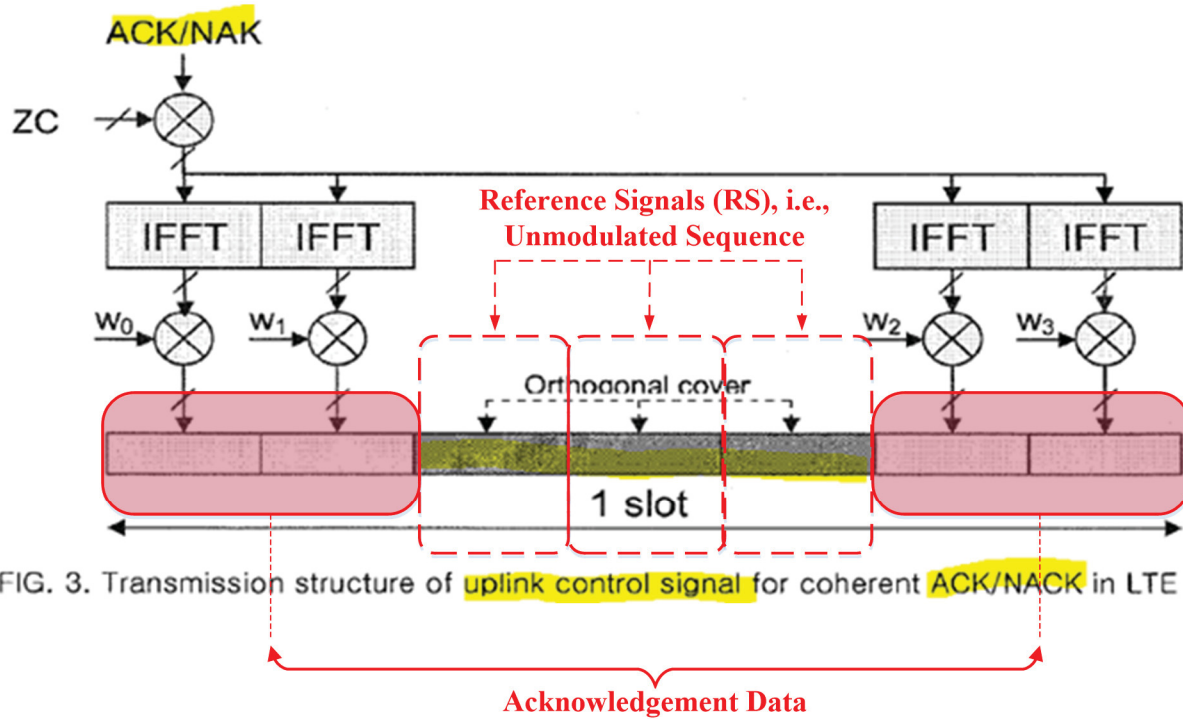


FIG. 3. Transmission structure of uplink control signal for coherent ACK/NACK in LTE

95. KwakProv812, FIG.3 (annotated)

D. [1D] “for a case where there is also a scheduling request to be sent, combining the acknowledgment with the scheduling request on a scheduling resource,⁴”

96. KwakPat883 discloses “when both the ACK/NACK signal and the scheduling request are transmitted in the subframe” (i.e., for a case where there

⁴

Moreover, the ‘688 Patent uses the term “resource” broadly to at least encompass a “channel” and “resource(s) configured for channels”:

The ‘688 Patent repeatedly equates “resource” with “channel” by numerous recitations of “SR **resources** (SR [physical uplink control **channel**, PUCCH]) and “ACK/NACK **resource** (ACK/NACK **PUCCH**),” HUAWEI-1001, 5:22-32, 5:46-6:45.

The ‘688 Patent also references “resource” as “**resource(s) configured for channels**”: “ACK/NACK **resources configured for** 18 parallel ACK/NACK **channels**” and “SR **resources configured for** 72 parallel SR **channels**.” (HUAWEI-1001, 4:22-24) and notes that “Any reference to ‘**resource**’ should be construed as covering a single resource or multiple **resources assigned for the specified signaling**” (HUAWEI-1001, 5:41-43).

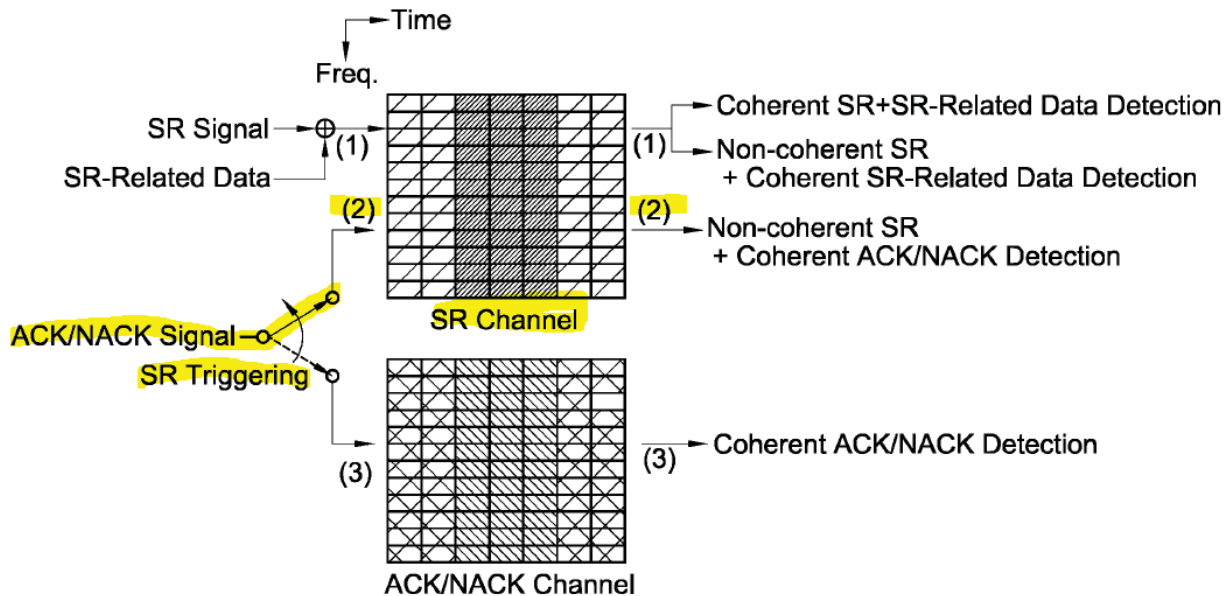
Regardless, KwakPat883 satisfies this “resource” feature by, for example, expressly referencing a “scheduling request **resource**” and further providing that “**the uplink control channel which is configured by** the scheduling request **resource**.” *See e.g.*, HUAWEI-1005, 3:17-19. *See also* ¶¶ 96-97 of this Declaration.

is also a scheduling request to be sent), “**transmitting the ACK/NACK signal and the scheduling request on the uplink control channel which is configured by the scheduling request resource**” (i.e., *combining the acknowledgment with the scheduling request on a scheduling resource*), HUAWEI-1005, 3:17-19. *See also id.*, FIG. 9, 11:63-12:8.

KwakProv812 satisfies this feature by referencing the “**SR channel and the ACK/NACK channel [] configured in the allocated time-frequency resources**” and “**configure a dedicated SR channel by allocating certain time/frequency/code resources**. *See e.g.*, HUAWEI-1007, 52:1-2; 50:9-10; 52:13-14. *See also* ¶¶ 98-99 of this Declaration.

LGE satisfies this feature by expressly referencing “**dedicated resource for SR**” and “**common resource assigned for ACK/NACK transmission**” corresponding to a “**dedicated SR channel and “ACK/NACK channel”** in FIG.5, respectively, and disclosing “**ACK/NACK signal [] diverted to the dedicated resource which is assigned to the UE for SR transmission from common resource for ACK/NACK signal.**” *See e.g.*, HUAWEI-1013, pp. 5-6. *See also* ¶¶ 182-183 of this Declaration.

FIG. 9



97. KwakPat883, FIG.9 (with highlighted path (2))

98. KwakProv812 supports KwakPat883's disclosure by disclosing: "[i]f the transmission of the ACK/NACK signal is required at the SR transmission like (2) of FIG.7, both the SR and ACK/NACK can be transmitted through the previously allocated SR channel." HUAWEI-1007, 59:16-18.

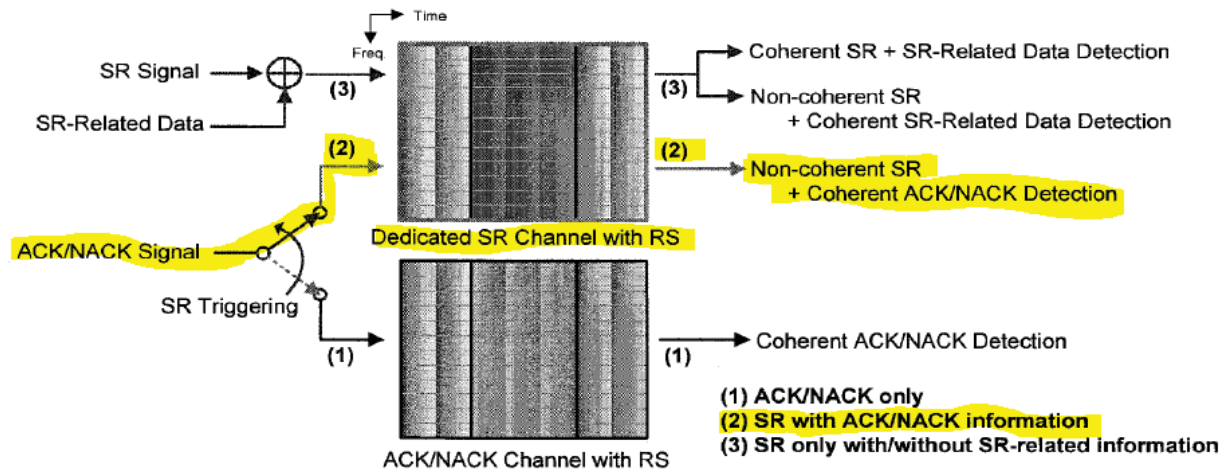


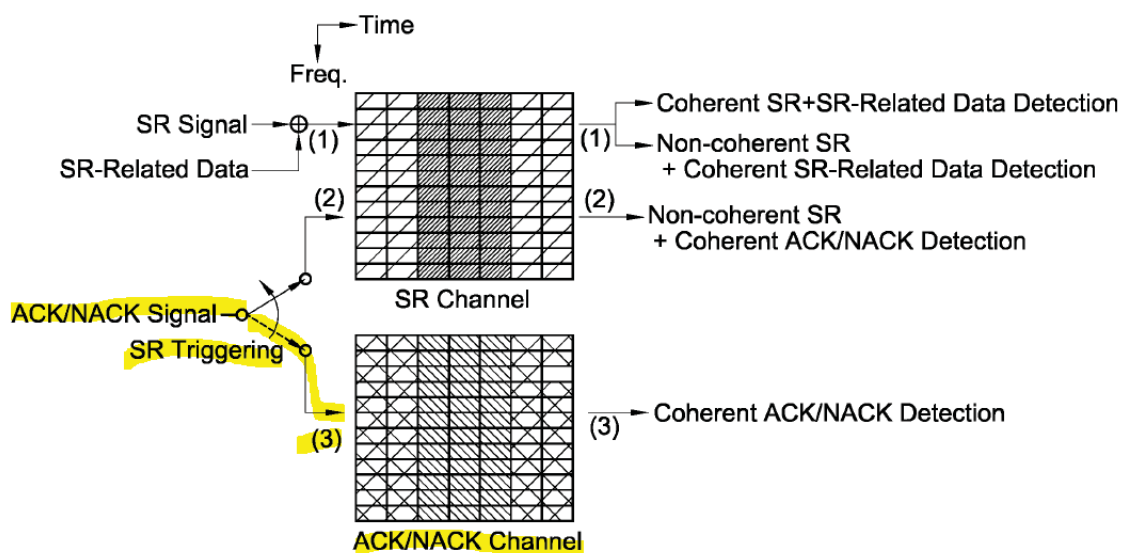
FIG. 7. Method for transmitting and receiving SR signals through the coherent SR channels having the dedicated RS

99. KwakProv812, FIG.7 (with highlighted path (2))

E. [1E] “else placing the acknowledgment in another resource”

100. KwakPat883 discloses *else placing the acknowledgment in another resource* (i.e., “an ACK/NACK channel which is configured by an ACK/NACK resource for the ACK/NACK signal”): as shown in FIG.9, “In the path (3), **when only the ACK/NACK signal is transmitted, the ACK/NACK signal is transmitted on an ACK/NACK channel which is configured by an ACK/NACK resource for the ACK/NACK signal.**” HUAWEI-1005, 12:9-12.

FIG. 9



101. FIG. 9 of KwakPat883 (with highlighted path (3))

102. KwakProv812 supports KwakPat88's disclosure by disclosing: **"if only the ACK/NACK is transmitted like (1) of FIG.7, the ACK/NACK information undergoes the coherent modulation/demodulation through the previously allocated ACK/NACK channels."** HUAWEI-1007, 59:22-24.

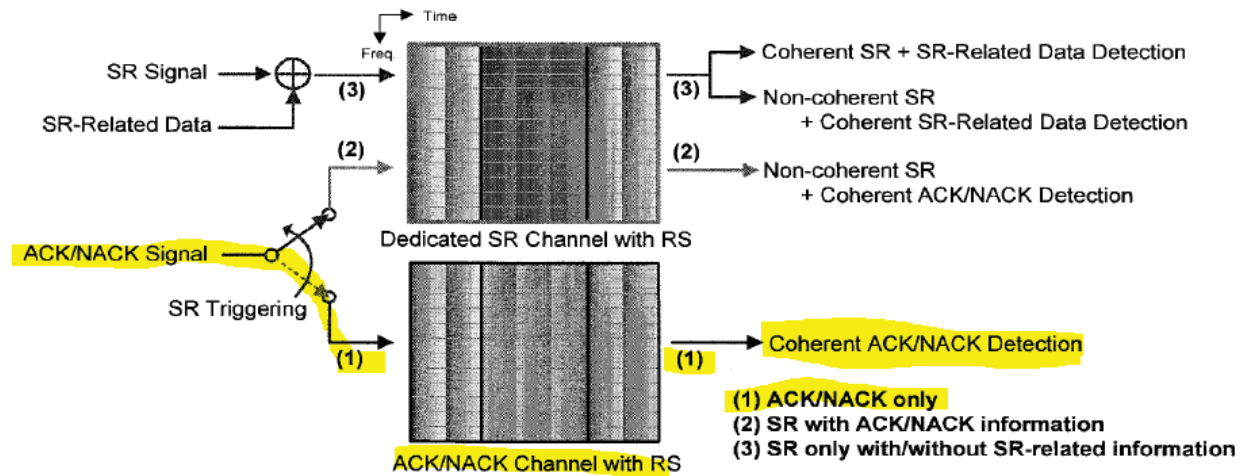


FIG. 7. Method for transmitting and receiving SR signals through the coherent SR channels having the dedicated RS

103. KwakProv812, FIG.7 (with highlighted path (1))

F. [2] *“The method of claim 1, comprising: for the case where there is also the scheduling request to be sent, transmitting the acknowledgment with the scheduling request on the scheduling resource.”*

104. KwakPat883 discloses “when both the ACK/NACK signal and the scheduling request are transmitted in the subframe” (i.e., *for a case where there is also a scheduling request to be sent*), “**transmitting the ACK/NACK signal and the scheduling request on the uplink control channel which is configured by the scheduling request resource**” (i.e., *transmitting the acknowledgment with the scheduling request on the scheduling resource*), HUAWEI-1005, 3:17-19. KwakProv812 supports KwakPat883 ’ s disclosure by disclosing: “[i]f the transmission of the ACK/NACK signal is required at the SR transmission like (2) of FIG.7,

both the SR and ACK/NACK can be transmitted through the previously allocated SR channel.” HUAWEI-1007, 59:16-18.

G. [4] “The method of claim 1, where the another resource is a data-non-associated resource.”

105. The ‘688 Patent identifies “data-non-associated (DNA) resources, such as ACK/NACK PUCCH,” HUAWEI-1001 6:38-40.

106. KwakPat883 discloses the another resource is an ACK/NACK PUCCH: “**an ACK/NACK resource** for transmitting an ACK/NACK signal ... **on the uplink control channel**,” wherein “[a]n uplink control channel assigned to the control region is referred to as a **physical uplink control channel (PUCCH)**.” HUAWEI-1005, 5:41-43, FIG. 4.

107. KwakProv812 supports KwakPat883’s disclosure by identifying the another resource (i.e., “the ACK/NACK channel [...] configured in allocated time-frequency resources,” HUAWEI-1007, 52:1-2) as an uplink control channel: “Transmission structure of **uplink control signal** for coherent ACK/NACK in LTE,” (*id.*, FIG. 3 Title). See prior explanation of KwakProv812’s disclosure that the uplink control channel (e.g., the ACK/NACK channel) is on a PUCCH in ¶¶ 74-77 of this Declaration.

H. [5] “The method of claim 2, where the transmitting is on a physical uplink control channel.”

108. “The transmitting” refers to the “transmitting the acknowledgment with the scheduling request on the scheduling resource” as recited in claim 2.

109. KwakPat883 discloses the “**scheduling request resource** for transmitting a scheduling request and the ACK/NACK signal **on the uplink control channel**,” wherein “[a]n **uplink control channel** assigned to the control region is referred to as a **physical uplink control channel (PUCCH)**.” HUAWEI-1005, 5:41-43, FIG. 4.

110. KwakProv812 supports KwakPat883’s disclosure by disclosing: “like (2) of FIG.7, **both the SR and ACK/NACK can be transmitted through** the previously allocated **SR channel** [i.e., the scheduling resource].” HUAWEI-1007, 59:16-18. KwakProv812 further supports that the SR channel is on a PUCCH by explaining that the SR channel is “like an LTE ACK/NACK channel” (HUAWEI-1007, 51:20) that is on PUCCH. *See* prior explanation of KwakProv812’s disclosure that the uplink control channel (e.g., the ACK/NACK channel) is on a PUCCH in ¶¶ 74-77 of this Declaration.

I. [6] “The method of claim 2, where the transmitting is on an uplink.”

111. KwakPat883 discloses that the transmitting is on an uplink by disclosing that the transmitting is on a physical **uplink** control channel by a UE. *See* Section XI, [5].

J. [7A] “The method of claim 1, where the physical uplink control channel comprises an unmodulated sequence, where the unmodulated sequence comprises reference signals and”

112. As discussed in Section IX of this Declaration, “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” encompasses “an unmodulated sequence,” and the “unmodulated sequence” further encompasses reference signals (RS). KwakPat883 discloses that transmission of the acknowledgement comprises reference signals, which is supported by KwakProv812. *See* Section XI, [1C]. *See also* the ‘688 Patent’s admitted prior art teaching that the reference signals are unmodulated sequences in Section VIII-D.

K. [7B] “the acknowledgement data comprises a BPSK/QPSK modulated sequence.”

113. The phrase “BPSK/QPSK” should refer to “BPSK or QPSK” given that BPSK and QPSK are alternative modulation schemes for transmitting either 1 bit or 2 bits of information, which is acknowledged by the ‘688 Patent: “BPSK is used for 1-bit ACK/NACK and QPSK for 2-bit ACK/NACK.” HUAWEI-1001, 2:8-9.

114. KwakPat883 discloses that the acknowledgement data comprises a QPSK modulated sequence: “The **ACK/NACK signal (e.g., a QPSK symbol)** is transmitted on a scheduling request channel.” HUAWEI-1005, 11:64-65.

115. KwakProv812 supports such disclosure by recognizing that the acknowledgement data comprises a modulated sequence: “the **ACK/NACK infor-**

mation is obtained by the same coherent demodulation as the existing demodulation method of the ACK/NACK channel” (HUAWEI-1007, 59:19-20) and KwakProv812 further discloses that a modulated sequence can be a QPSK modulated sequence for transmitting 2 bits of information: **“2-bit transmission is achieved by QPSK modulation ..., additional information can be all transmitted by QPSK modulation and thus additional information transmission of the maximum 2bit is possible.”** HUAWEI-1007, 59:11-16. Accordingly, a POSITA would have found it readily obvious that when there is 2-bit ACK/NACK information, the 2-bit ACK/NACK information would be modulated by QPSK as suggested by KwakProv812, and hence the acknowledgement data comprises a QPSK modulated sequence. *See id.* *See also* the ’688 Patent’s admitted prior art teaching that acknowledgment data (e.g., ACK/NACK signals) includes a modulated BPSK or QPSK sequence. Section VIII-C, *supra*.

L. [8] “The method of claim 1 implemented in a wireless communications network.”

116. KwakPat883 discloses “[a] **“method of transmitting uplink control signals in a wireless.”** HUAWEI-1005, Abstract, and FIG.1 “shows **a wireless communication system.**” HUAWEI-1005, 3:58; 4:32.

117. KwakProv812 supports KwakPat883’s disclosure by disclosing **“a broadband communication system [...] to maximize efficiency in limited wireless resources.”** HUAWEI-1007, 48:21-23.

M. [9] “The method of claim 1 implemented in an evolved universal terrestrial radio access network.”

118. While KwakPat883 does not expressly recite “an evolved universal terrestrial radio access network,” it incorporates by reference KwakProv812 that discloses that the method of claim 1 is implemented in LTE: “a transmission structure for an uplink control signal in **long term evolution (LTE)**.” HUAWEI-1007, 49:3-4, FIG.3. HUAWEI-1006, p.309. As admitted by the ‘688 Patent and obvious to a POSITA that LTE is “long term evolution of UTRAN (E-UTRAN)” and “E-UTRAN” stands for “evolved universal terrestrial radio access network.” HUAWEI-1001, 1:46-47. *See* Section VIII-A of this Declaration. Thus, a POSITA would readily understand that KwakPat883 discloses that the method of claim 1 is implemented in an E-UTRAN.

N. [37A] “A method comprising:”

119. *See* Section XI, [1A], *supra*.

O. [37B] “determining that a scheduling request resource and at least one other resource are reserved for a user equipment in a same sub-frame; and”

120. KwakPat883 discloses determining that a scheduling request resource is reserved/prepared for a user equipment (UE): “preparing a scheduling request resource for transmitting a scheduling request;” HUAWEI-1005, Abstract. “The SR is a signal transmitted when it is required by the UE.” HUAWEI-1005, 12:19-20. FIG. 9 shows a scheduling request resource (i.e., a “SR Channel”/“scheduling request

channel assigned with a scheduling request resource”) reserved for the UE for transmitting the SR only (path (1)) as well as an ACK/NACK signal (path (2)):

In the path (1), if only the SR is transmitted on a scheduling request channel, the SR is transmitted on **the scheduling request channel assigned with a scheduling request resource**. **The scheduling request resource can be regarded as a resource for the SR**. When considering the path (2), **the scheduling request resource can be regarded as a resource for simultaneously transmitting the SR and the ACK/NACK signal**. Information on **the scheduling request resource may be predetermined** between a BS and a UE or may be reported by the BS to the UE.

In the path (2), the SR and the ACK/NACK signal are simultaneously transmitted. The ACK/NACK signal is transmitted on **a scheduling request channel** which is configured for **a scheduling request resource allocated to transmit the SR**.

HUAWEI-1005, 11:46-55, 11:63-66.

121. KwakProv812 supports KwakPat883’s disclosure by disclosing that a scheduling request resource (e.g., a “dedicated SR channel” with allocated codes) is reserved for a UE: **“the 2D spreading codes in the ACK/NACK are effectively reserved for the SR transmission and allocated for the SR, so that a SR dedicated channel can be configured.”** HUAWEI-1007, 52:28-30. “[A] “certain UE is required to transmit the SR signal and the control signal.” HUAWEI-1007, 51:10-11. *See also* HUAWEI-1007, 59:7-18, FIG. 7.

122. KwakPat883 discloses at least one other resource (i.e., an “ACK/NACK Channel”/“ACK/NACK channel which is configured by an ACK/NACK resource”) is reserved for the UE: “preparing a ACK/NACK resource for transmitting the ACK/NACK signal for HARQ of downlink data on an uplink

control channel” HUAWEI-1005, Abstract. **“Transmission of the ACK/NACK signal is predetermined** according to transmission of downlink data.” HUAWEI-1005, 12:20-21. “In the path (3), when only the ACK/NACK signal is transmitted, the ACK/NACK signal is transmitted on **an ACK/NACK channel** which is **configured by an ACK/NACK resource** for the ACK/NACK signal.” HUAWEI-1005, 12:9-12.

123. KwakProv812 further supports KwakPat883’s disclosure by disclosing that at least one other resource (e.g., an “ACK/NACK Channel” with allocated codes) is reserved by allocating codes for the UE: **“the existing channel for transmitting the ACK/NACK control signal** as shown in FIG.3, the control channel is **configured by 2D spreading using ZC codes in the frequency domain and orthogonal codes....”** HUAWEI-1007, 52:22-25.

124. KwakPat883 further discloses that the scheduling request resource (i.e., the “SR channel” configured with sequences) and the at least one other resource (i.e., the “ACK/NACK Channel” configured with sequences) are reserved for a UE in a same subframe by disclosing that **“preparing a ACK/NACK resource** for transmitting the ACK/NACK signal for HARQ of downlink data on an uplink control channel, **preparing a scheduling request resource for transmitting** a scheduling request and the ACK/NACK signal on the uplink control channel **in one subframe”** HUAWEI-1005, Abstract.

125. KwakPat883 goes on to disclose that the scheduling request resource and the ACK/NACK resource are reserved for simultaneous transmission of **the SR and the ACK/NACK signal in the same subframe**: “The SR is a signal transmitted when it is required by the UE. **Transmission of the ACK/NACK signal is predetermined** according to transmission of downlink data. Therefore, **one UE may simultaneously transmit the SR and the ACK/NACK signal in the same subframe.**” HUAWEI-1005, 12:19-23.

126. KwakProv812 supports KwakPat883’s above disclosure of determining that the scheduling request resource (i.e., the “SR channel” configured with sequences) and the at least one other resource (i.e., the “ACK/NACK Channel” configured with sequences) are reserved for a UE in a same subframe by disclosing that determining “[i]f **the transmission of the ACK/NACK signal is required at the SR transmission like (2) of FIG.7,**” (i.e., “**transmission [of SR] simultaneous with ... the ACK/NACK signal,**” “**both the SR and ACK/NACK can be transmitted through the previously allocated SR channel.**” HUAWEI-1007, 59:16-18; 52:17-20. *See also* FIG.7 where, upon the determining that SR is to be transmitted together with the ACK/NACK Signal at “SR Triggering,” path (2) is selected where the SR and the ACK/NACK are transmitted simultaneously in the SR channel, which “like an LTE ACK/NACK channel” has 7 symbols is “of one slot” “in the subframe” (as

shown in (1) in FIG.7 and FIG.3), HUAWEI-1007, 51:4, 6-7, 50:3-6, pp. 50&54, FIGS.2-4. *See also* Section X.D-F of this Declaration.

127. KwakPat883 further discloses that the channels (e.g., SR channel and ACK/NACK channel) are configured “using sequence allocation.” HUAWEI-1005, 8:22-23. Three sequence assignment methods for configuring the scheduling request channel and the ACK/NACK channels are given as examples. *See* HUAWEI-1005, 8:54-11:40. By reserving a certain number of sequences for the SR, a corresponding number of scheduling request channels is reserved, while the remaining number of sequences are reserved for the ACK/NACK channels. *See id.*, Tables 1- 6. Take Table 1 as an example, KwakPat883 discloses that “when one cyclic shift [of a sequence] is assigned to transmit the SR, three scheduling request channels can be generated. In this case, the number ACK/NACK channels decreases by 3.” HUAWEI-1005, 9:46-48.

TABLE 1

The number of reserved frequency domain sequence	The number of SR channels with SR-RS	The number of ACK/ NACK channels
0	0	18
1	3	15
2	6	12
...
6	18	0

128. Table 1 of KwakPat883

129. KwakProv812 supports KwakPat883's above disclosures by disclosing that "configuring an SR channel and an ACK/NACK channel through the code allocation." HUAWEI-1007, 52:13-14. Particularly, "(6) The ACK/NACK channel and the SR channel have to be flexibly **configured in the allocated time-frequency resources**. (7) The flexibility of code allocation has to be enhanced when **a dedicated SR channel is configured through the code allocation**." HUAWEI-1007, 52:3-4. The SR channel is "compatible with the existing ACK/NACK channel structure as shown in FIG.3" that includes 7 SC-FDM symbols **in a same slot and hence in a same subframe**. *See* HUAWEI-1007, 49:22-23, FIGS.2 and 3.

130. Specifically, the SR channel is reserved by allocating a certain number of codes for the SR, while the remaining number of codes are reserved for the ACK/NACK channels for simultaneous transmission of **the SR and the ACK/NACK signal** ("the 2D spreading **codes** in the ACK/NACK are effectively **reserved for the SR transmission and allocated for the SR**, so that **a SR dedicated channel can be configured....** when **both the SR signal and the ACK/NACK signal are simultaneously transmitted**." HUAWEI-1007, 52:28-33).

131. KwakProv812 also supports KwakPat883's above disclosure by disclosing three "code allocation methods for configuring the ACK/NACK channel and

the dedicated SR channel,” HUAWEI-1007, 53:2-10 and by disclosing the same tables as Tables 1-6 of KwakPat883. *See* HUAWEI-1007, 52:20-66:8, All Tables. As an example, Table 1 of KwakProv812 is the same as Table 1 of KwakPat883, with the similar description:

In the ACK/NACK channel structure of the LTE, if it is possible to generate 6 orthogonal spreading codes through a circular shift with regard to one ZC root sequence in the frequency domain, three SR channels supportable to one allocated circular shift can be generated depending on the orthogonal spreading codes in 3-RS, and thus three ACK/NACK channels are decreased.

HUAWEI-1007, 54:2-6

<Table 1> Change in the number of dedicated SR and ACK/NACK channels according to the allocation of the frequency-domain spreading codes

The Number of Reserved Freq.-Domain Spreading Codes	The Number of Coherent SR Channels with Dedicated RS	The Number of ACK/NACK Channels
0	0	18
1	3	15
2	6	12
⋮	⋮	⋮
6	18	0

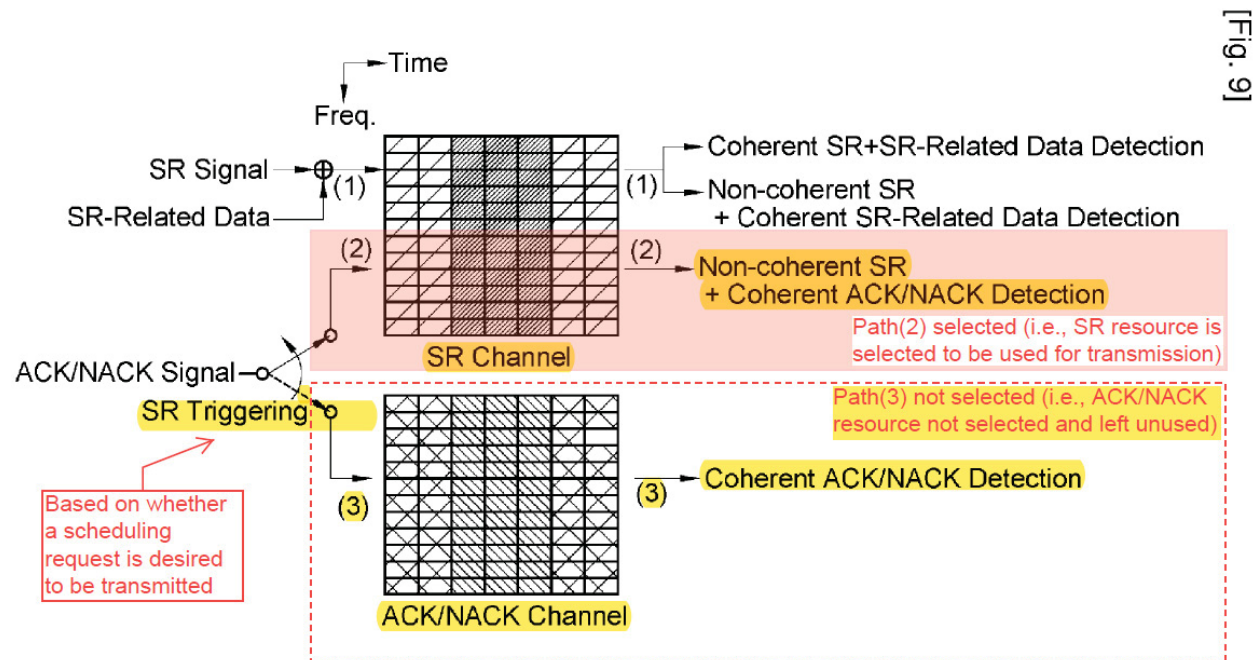
132. Table 1 of KwakProv812

133. Indeed, KwakProv812 discloses that “like (2) of FIG.7, **both the SR and ACK/NACK can be transmitted** through the previously **allocated SR channel**” having 7 symbols in a same slot, HUAWEI-1007, 59:17-18, the dedicated SR channel with allocated codes (i.e., scheduling request resource) and ACK/NACK channel with allocated codes (i.e., at least one other resource) are both reserved and

indeed transmitted in the same slot and, hence, in the same subframe. HUAWEI-1007, FIG.7.

P. [37C] “based on whether a scheduling request is desired to be transmitted by the user equipment, placing at least one of an acknowledgment/negative acknowledgement and a channel quality indicator that is desired to be transmitted by the user equipment in one of the resources and leaving at least one other resource unused,”

134. As shown in below annotated FIG. 9, KwakPat883 discloses that, based on whether a scheduling request is desired to be transmitted by the UE, it triggers placing ACK/NACK signal (i.e., at least *one of an acknowledgment/negative acknowledgement and a channel quality indicator*) that is desired to be transmitted by the UE in one of the resources (i.e., “a scheduling request channel which is configured for a scheduling request resource”): “In the path (2), the SR and the ACK/NACK signal are simultaneously transmitted. The ACK/NACK signal is transmitted on a **scheduling request channel which is configured for a scheduling request resource** allocated to transmit the SR.” HUAWEI-1005, 11:63-66. *See also* footnote 4 of this Declaration. In this instance, Path (2) is selected over Path (3), thus leaving at least one other resource (e.g., “ACK/NACK channel which is configured by an ACK/NACK resource”) in Path (3) unused: “In the path (3), when only the ACK/NACK signal is transmitted, the ACK/NACK signal is transmitted on an ACK/NACK channel which is configured by an ACK/NACK resource for the



135. KwakPat883, FIG.9 (annotated)

136. KwakProv812 supports KwakPat883’s disclosure: as shown in below annotated FIG.7 of KwakProv812, based on whether a scheduling request is desired to be transmitted by the user equipment, it triggers placing ACK/NACK signal (i.e., *at least one of an acknowledgment/negative acknowledgement and a channel quality indicator*) that is desired to be transmitted by the UE in one of the resources (i.e., “allocated SR channel”): “If the transmission of the ACK/NACK signal is required at the SR transmission like (2) of FIG.7, both the SR and ACK/NACK can be transmitted through the previously **allocated SR channel**.” HUAWEI-1007, 59:16-24. In this case, Path (2) is selected over Path (1), thus leaving at least one other resource (e.g., “allocated ACK/NACK channels”) in Path (1) unused: “Lastly, **if only the**

ACK/NACK is transmitted like (1) of FIG.7, the ACK/NACK information undergoes the coherent modulation/demodulation through the previously **allocated ACK/NACK channels.**” HUAWEI-1007, 59:22-24. *See also* footnote 4 of this Declaration.

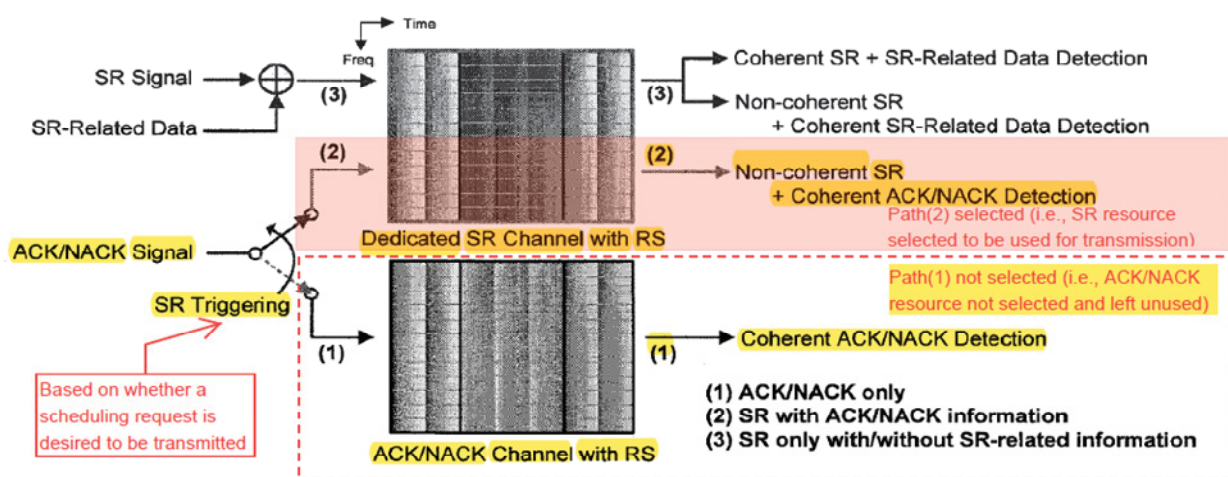


FIG. 7. Method for transmitting and receiving SR signals through the coherent SR channels having the dedicated RS

137. KwakProv812, FIG.7 (annotated)

138. Moreover, KwakPat883 discloses the two channels (e.g., SR channel and ACK/NACK channel) are configured by allocating different sequences. *See* HUAWEI-1005, 8:22-23; 8:54-11:40, Tables 1-6. *See also* footnote 4 of this Declaration. Use of one of the resources (e.g., “a scheduling request channel which is configured for a scheduling request resource”) would leave the another resource (e.g., “ACK/NACK channel which is configured by an ACK/NACK resource”) un-

used given that the scheduling request channel and the ACK/NACK channel are allocated with different, non-overlapping set of sequences. *See e.g.*, HUAWEI-1005, 8:22-23; 8:54-11:40, Tables 1-6. Choosing the scheduling request channel allocated with one set of sequences renders the ACK/NACK channel allocated with another set of sequences unused. *See id.*

139. KwakProv812 supports KwakPat883's above disclosure: "configuring an SR channel and an ACK/NACK channel through the code allocation." KwakProv812 at 6:13-14. The SR channel and ACK/NACK channel are allocated with different sequences. *See e.g.*, KwakProv812's similar disclosure of "code allocation methods for configuring the ACK/NACK channel and the dedicated SR channel," HUAWEI-1007, 53:2-10 and the same tables as Tables 1-6 of KwakPat883. HUAWEI-1007, 52:20-66:8, All Tables. Similarly, use of one of the resources (e.g., "allocated SR channel") would leave the another resource (e.g., "allocated ACK/NACK channel") given that the allocated SR channel and the allocated ACK/NACK channel have different, non-overlapping set of sequences. *See id.* Choosing the scheduling request channel allocated with one set of sequences renders the ACK/NACK channel allocated with another set of sequences unused. *See id.*

Q. [37D] "where the transmission comprises in addition to acknowledgement data, a sequence that is unmodulated via a modulation scheme used for the acknowledgment data."

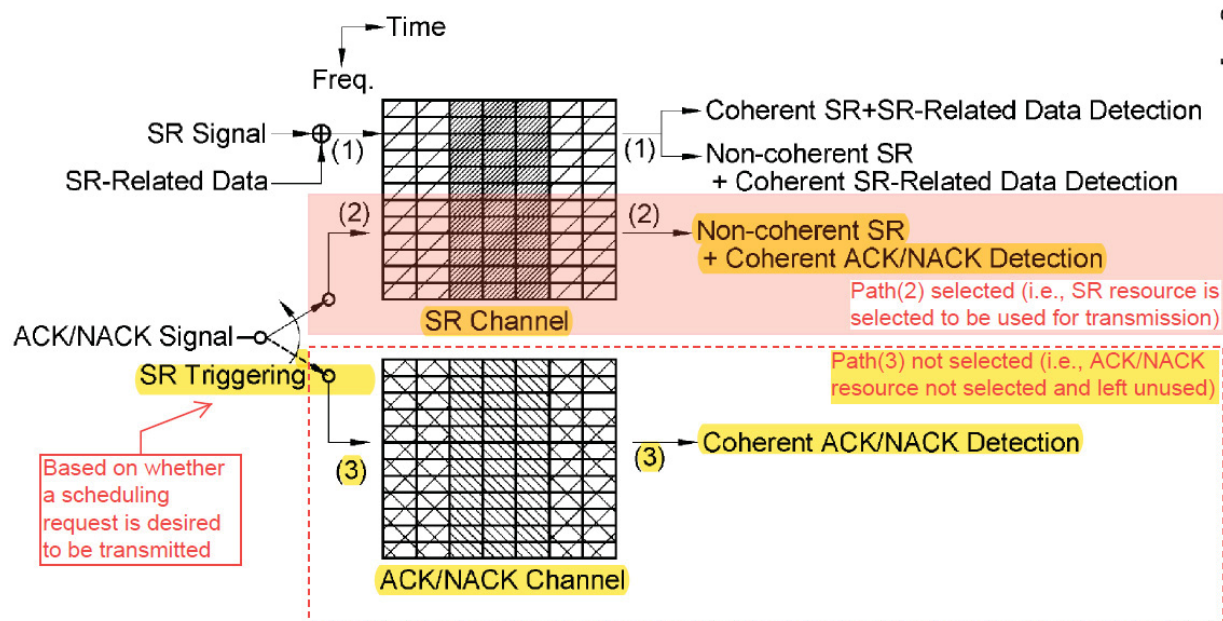
140. *See* Section XI, [1C], *supra*.

R. [38] *“The method of claim 37, where the scheduling request resource and the at least one other resource are physical uplink control channel resources.”*

141. See Section XI, [1B] and [5], *supra*.

S. [39A] *“The method of claim 37 comprising: for a case where the user equipment desires to transmit a scheduling request and transmit an acknowledgment/negative acknowledgement, transmitting the acknowledgment/negative acknowledgement with the scheduling request on the scheduling request resource and leaving the at least one other resource unused.”*

142. As shown in below annotated FIG. 9, KwakPat883 discloses: “In the path (2), the SR and the ACK/NACK signal are simultaneously transmitted [i.e., for a case where the user equipment desires to transmit a scheduling request and transmit an acknowledgment/negative acknowledgement]. The ACK/NACK signal is transmitted on a scheduling request channel which is configured for a scheduling request resource allocated to transmit the SR [i.e., transmitting the acknowledgment/negative acknowledgement with the scheduling request on the scheduling request resource].” HUAWEI-1005, 11:63-67. In this instance, Path (2) is selected over Path (3), thus leaving at least one other resource (e.g., “ACK/NACK channel which is configured by an ACK/NACK resource”) in Path (3) unused. See HUAWEI-1005, 12:9-12. See also Section XI, [37C], *supra*.



143. KwakPat883, FIG.9 (annotated)

144. KwakProv812 supports KwakPat883's disclosure: as shown in below annotated FIG.7, KwakProv812 discloses that "If the **transmission of the ACK/NACK signal is required at the SR transmission** like (2) of FIG.7," (i.e., *for a case where the user equipment desires to transmit a scheduling request and transmit an acknowledgment/negative acknowledgement*), "**both the SR and ACK/NACK can be transmitted through the previously allocated SR channel,**" HUAWEI-1007, 59:17-18 (i.e., *transmitting the acknowledgment/negative acknowledgement with the scheduling request on the scheduling request resource*). See HUAWEI-1007, 59:22-24; 52:20-66:8, All Tables. See also Section XI, [37C], *supra*.

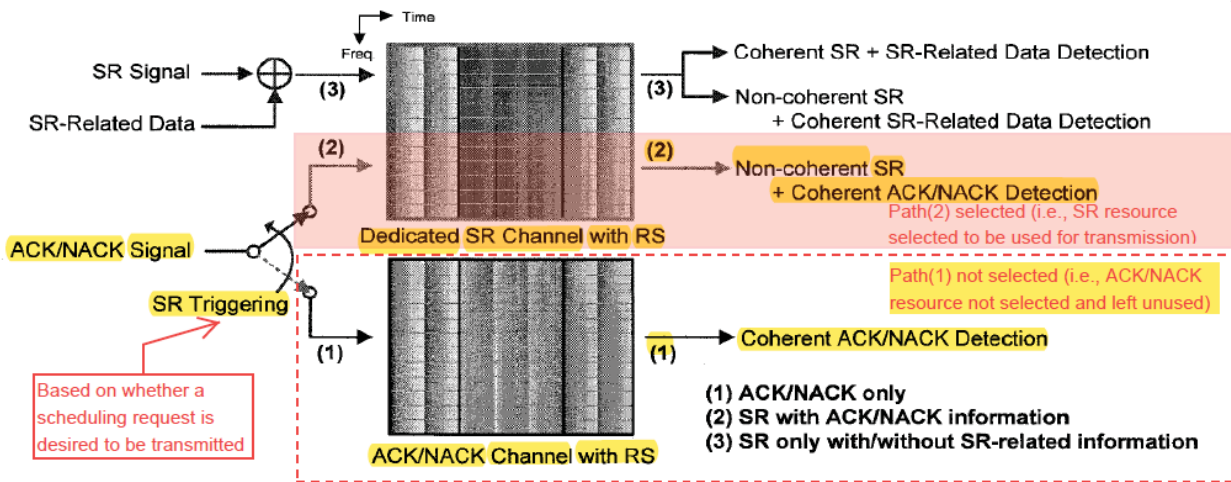


FIG. 7. Method for transmitting and receiving SR signals through the coherent SR channels having the dedicated RS

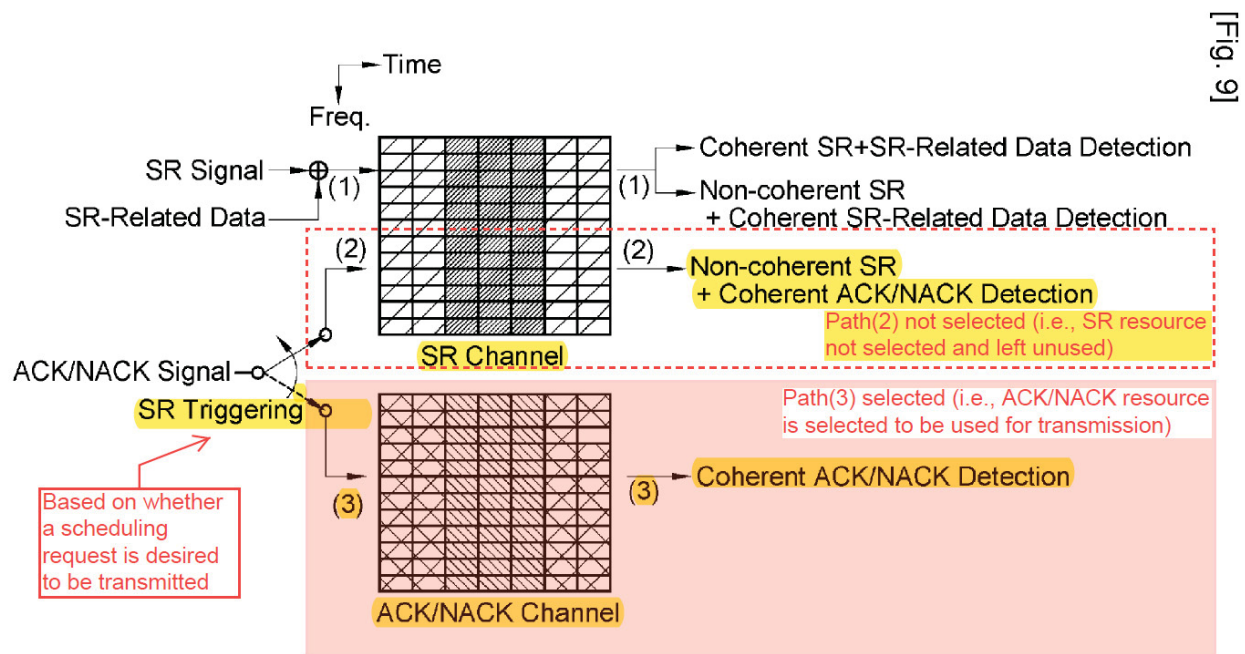
145. KwakProv812, FIG.7 (annotated)

T. *[39B] “or for a case where the user equipment does not desire to transmit a scheduling request and does desire to transmit an acknowledgment/negative acknowledgement, transmitting the acknowledgment/negative acknowledgement on the at least one other resource and leaving the scheduling request resource unused.”*

146. Note that claim 39 recites claim element [39A] “or” claim element [39B]. KwakPat883 thus satisfies claim 39 already by disclosing claim element [39A] as described above. Moreover, KwakPat883 also discloses claim element [39B] as discussed below.

147. For example, as show in Path (3) of below annotated FIG.9, Kwak-Pat883 discloses that *where the user equipment does not desire to transmit a scheduling request and does desire to transmit an acknowledgment/negative acknowledgement (i.e., ACK/NACK Signal without SR), transmitting the acknowledgment/negative acknowledgement on the at least one other resource (e.g.,*

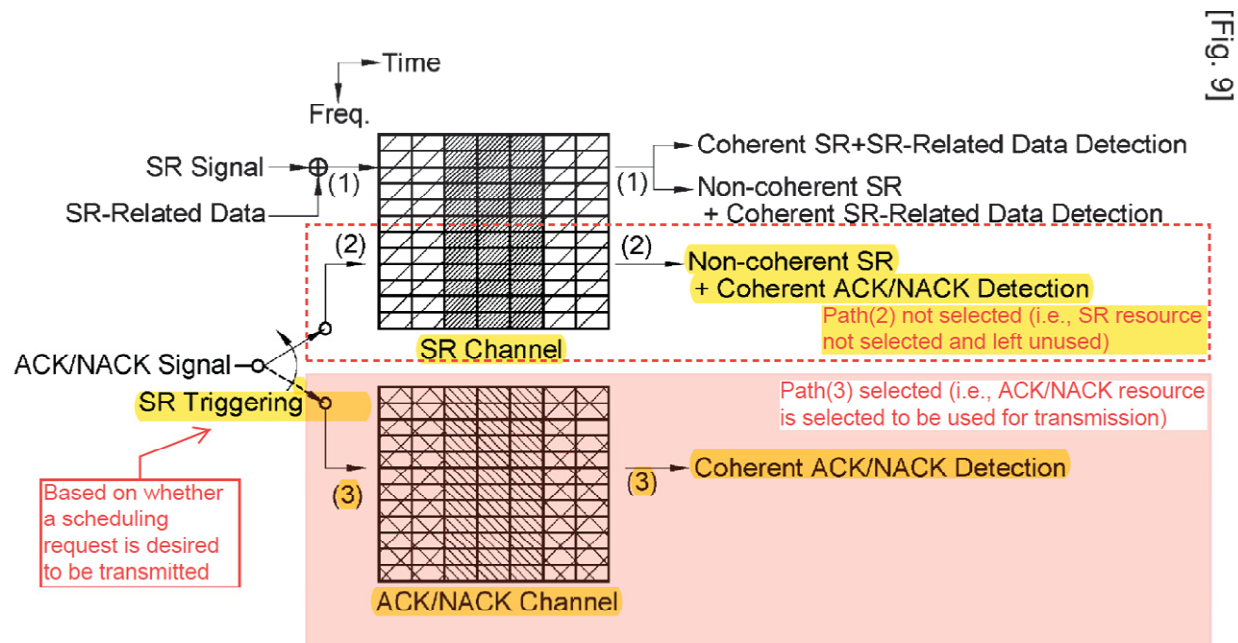
“ACK/NACK Channel”) in Path (3) (e.g., “ACK/NACK channel which is configured by an ACK/NACK resource”): “In the path (3), **when only the ACK/NACK signal is transmitted**, the ACK/NACK signal is **transmitted on an ACK/NACK channel which is configured by an ACK/NACK resource for the ACK/NACK signal.**” HUAWEI-1005, 12:9-12. Consequently, the scheduling request resource (i.e., “a scheduling request channel which is configured for a scheduling request resource”) in Path (2) is left unused. *See id.*



148. KwakPat883, FIG.9 (with annotations)

149. KwakProv812 supports KwakPat883’s disclosure by disclosing Path (1) of below annotated FIG.7, which corresponds to Path (3) of KwakPat883’s FIG.9, for transmitting the acknowledgment/negative acknowledgement on the at least one other resource (e.g., “allocated ACK/NACK channels”) in Path (1), thus leaving the

scheduling request resource (i.e., “allocated SR channel”) in Path (2) unused: “**if only the ACK/NACK is transmitted like (1) of FIG.7, the ACK/NACK information** undergoes the coherent modulation/demodulation through the previously **allocated ACK/NACK channels.**” HUAWEI-1007, 59:22-24. “If the transmission of the ACK/NACK signal is required, the SR transmission like (2) of FIG.7, **both the SR and ACK/NACK can be transmitted** through the previously **allocated SR channel.**” HUAWEI-1007, 59:16-18.



150. KwakProv812, FIG.7 (annotated)

151. Also, KwakPat883 discloses the two channels (e.g., SR channel and ACK/NACK channel) are configured by allocating different sequences. See HUAWEI-1005, 8:22-23; 8:54-11:40, and Tables 1-6. Use of the at least one other

resource (e.g., “ACK/NACK channel which is configured by an ACK/NACK resource”) with one set of sequences would leave the scheduling request resource (e.g., “a scheduling request channel which is configured for a scheduling request resource”) with another set of different sequences unused. *See e.g.*, KwakPat883, Tables 1-6. KwakProv812 supports KwakPat883’s above disclosure: “configuring an SR channel and an ACK/NACK channel through the code allocation.” KwakProv812 at 6:13-14. The SR channel and ACK/NACK channel are allocated with different sequences. *See e.g.*, KwakProv812’s similar disclosure of “code allocation methods for configuring the ACK/NACK channel and the dedicated SR channel,” HUAWEI-1007, 53:2-10 and the same tables as Tables 1-6 of KwakPat883. HUAWEI-1007, 52:20-66:8, All Tables. Similarly, use of the at least one other resource (e.g., “allocated ACK/NACK channel”) would leave the scheduling request resource (e.g., “allocated SR channel”) unused given that the allocated SR channel and the allocated ACK/NACK channel have different, non-overlapping set of sequences. *See id.* Choosing the ACK/NACK channel allocated with one set of sequences renders the scheduling request channel allocated with another set of sequences unused. *See id.*

U. [42] *“The method of claim 37, where the scheduling request information is conveyed based on a selected physical uplink control channel selection.”*

152. KwakPat883 explains that “The SR is used when a UE request a BS to allocate an uplink radio resource.... The BS has to only recognize a presence/absence of the SR. Therefore, **a positive transmission of the SR can be achieved with the presence of transmission of the SR, and a negative transmission of the SR can be achieved with the absence of transmission of the SR.**” HUAWEI-1005, 7:16-27. KwakPat883 further explains that “the scheduling request being used to request a radio resource for uplink transmission, wherein a **positive transmission of the scheduling request is carried by presence of its transmission on the uplink control channel and a negative transmission of the scheduling request is carried by absence of its transmission on the uplink control channel.**” HUAWEI-1005, 2:40-46.

153. As shown in below highlighted FIG. 9, KwakPat883 discloses that “SR triggering” causes the selection between “SR channel” and “ACK/NACK” channel, both of which are physical uplink control channels. *See* Section XI, [1B] [1D] and [5], footnote 4, *supra*. KwakPat883 goes on to disclose that the SR information (e.g., whether a SR is presented or not, i.e., whether the SR is positive or negative) is conveyed based on a selected physical uplink control channel selection (e.g., the SR

channel in the case of Path (2) when the SR and the ACK/NACK signal are simultaneously transmitted):

In the path (2), the SR and the ACK/NACK signal are simultaneously transmitted. The ACK/NACK signal is transmitted on a scheduling request channel which is configured for a scheduling request resource allocated to transmit the SR. The BS can detect the SR by using non-coherent detection. The BS can detect the ACK/NACK signal by using coherent detection. That is, according to **a presence/absence of transmission of the scheduling request channel, the BS can know whether the SR is transmitted.**

HUAWEI-1005, 11:63-12:4.

154. *See also* KwakPat883's disclosure that "The scheduling request channel and the ACK/NACK channel have the same structure except for time-frequency sequences assigned thereto. Therefore, when the UE transmits the ACK/NACK signal by using the scheduling request resource, **the BS can know the positive transmission of the SR with the presence of the scheduling request channel.**"

HUAWEI-1005, 12:35-38.

155. Accordingly, the scheduling request information (e.g., whether a SR is presented or not, i.e., whether is a positive or negative transmission of SR) is conveyed based on a selected physical uplink control channel selection (e.g., either "SR channel" or "ACK/NACK" channel).

156. KwakPat883, FIG.9 (highlighted)

157. KwakProv812 supports KwakPat883's above disclosure: as shown in below highlighted FIG. 7, KwakProv812 also discloses that "SR triggering" causes the selection between "SR channel" and "ACK/NACK" channel, both of which are physical uplink control channels. *See* Section XI, [1B] [1D] and [5], *supra*. KwakProv812 also discloses that "if the transmission of the ACK/NACK signal is required at the same time when the SR signal is transmitted, the ACK/NACK signal in a section where the SR information is transmitted is modulated and transmitted with respect to the SR channel configured as shown in FIG.4, so that **the receiver detects the SR signal through the non-coherent demodulation (e.g., demodulation of on-off keying)** with respect to the dedicated SR spreading code, and performs the coherent ACK/NACK demodulation through a channel estimation result based

on the SR dedicated RS with respect to the ACK/NACK signal.” HUAWEI-1007, 55:5-11. In other words, the 1-bit SR information (e.g., whether a SR is presented or not, i.e., whether the SR is positive or negative) is conveyed based on a selected physical uplink control channel selection (e.g., the SR channel when the SR and the ACK/NACK signal are simultaneously transmitted) by non-coherently detecting the SR information by means of energy detection. *See* HUAWEI-1013, p.4.

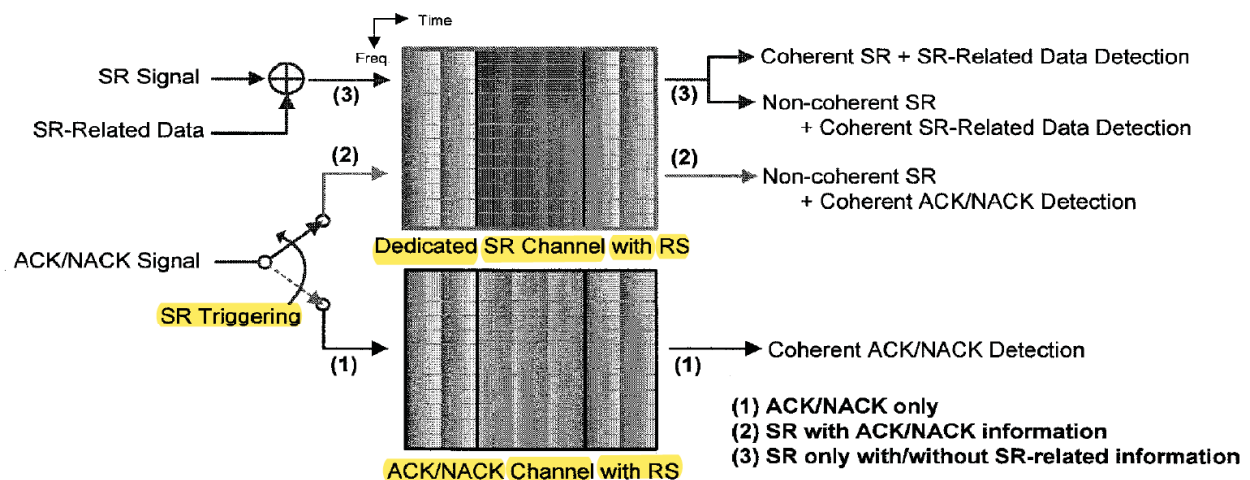


FIG. 7. Method for transmitting and receiving SR signals through the coherent SR channels having the dedicated RS

158. KwakProv812, FIG.7 (highlighted)

V. [43A] “A method comprising.”

159. *See* Section XI, [1A], *supra*.

W. [40B] “determining that an acknowledgment data transmission is to be sent.”

160. *See* Section XI, [1B], *supra*.

X. *[43C] “for a case where there is also a scheduling request to be sent, transmitting the acknowledgment data with the scheduling request on a scheduling resource in an uplink,*

161. See Section XI, [1D] and [2], *supra*.

Y. *[43D] “where there is no need to specify a separate modulation or multiplexing operation used for transmission of the acknowledgment data with the scheduling request, from a modulation or multiplexing operation used for transmission of the acknowledgement on another resource.”*

162. KwakPat883, through its incorporation of KwakProv812 by reference, discloses this feature by KwakProv812’s explanation that there is no need to specify a separate modulation or multiplexing operation used for transmission of the acknowledgement data with the scheduling request given that **“the ACK/NACK information is obtained by the same coherent demodulation as the existing demodulation method of the ACK/NACK channel”**:

If the transmission of the ACK/NACK signal is required at the SR transmission like (2) of FIG.7, **both the SR and ACK/NACK can be transmitted through the previously allocated SR channel. At this time, the SR information is detected by the non-coherent method, and the ACK/NACK information is obtained by the same coherent demodulation as the existing demodulation method of the ACK/NACK channel.**

HUAWEI-1007, 59:16-20.

163. KwakPat883 further discloses this feature that, in the case “where the SR and the ACK/NACK signal have to be simultaneously transmitted in the same subframe,” the modulation/demodulation of ACK/NACK does not need to change

by “transmit[ing] modulation symbols for the ACK/NACK signal through the scheduling request channel” so that “BS can obtain the ACK/NACK signal by using coherent detection through the scheduling request channel for transmitting timing at which the ACK/NACK signal is transmitted.” As a result, “existing resources can be utilized without having to reserve additional resources” (e.g., additional power or signaling overhead if a separate modulation or multiplexing operation were to be used) and “resource efficiency can be enhanced.” HUAWEI-1005, 12:28-47. By contrast, the other case “where a dedicated scheduling request channel is transmitted using a dedicated scheduling request resource without consideration of coexistence with the ACK/NACK channel, capability of the scheduling request channel is problematic,” the modulation/demodulation of ACK/NACK may need to change by transmitting “additional 1-bit information” “through QPSK modulation when the ACK/NACK signal is 1 bit”:

In a case where the SR and the ACK/NACK signal have to be simultaneously transmitted in the same subframe, **the UE spreads and transmits modulation symbols for the ACK/NACK signal** through the scheduling request channel assigned with the scheduling request resource for transmission of the SR. **The scheduling request channel and the ACK/NACK channel have the same structure except for time-frequency sequences assigned thereto.** Therefore, when the UE transmits the ACK/NACK signal by using the scheduling request resource, the BS can know the positive transmission of the SR with the presence of the scheduling request channel. Further, the BS can **obtain the ACK/NACK signal by using coherent detection** through the scheduling request channel **for transmitting timing at which the ACK/NACK signal is transmitted.**

Accordingly, **existing resources can be utilized without having to reserve additional resources** for simultaneously transmitting the SR and the ACK/NACK signal. Therefore, **resource efficiency can be enhanced**.

Meanwhile, **in a case where a dedicated scheduling request channel is transmitted using a dedicated scheduling request resource without consideration of coexistence with the ACK/NACK channel, capability of the scheduling request channel is problematic**. For example, if non-coherent detection is used in one resource block (RB) and one subframe, a maximum of 42 scheduling request channels can be generated through two-dimensional spreading. Therefore, **if it is assumed that the existing ACK/NACK channel and the scheduling request channel do not coexist, to transmit the SR through the ACK/NACK channel, there is a need for a method capable of transmitting additional 1-bit information through the existing ACK/NACK channel**.

An additional 1-bit SR can be transmitted **through QPSK modulation when the ACK/NACK signal is 1 bit**. The SR can be transmitted by changing a phase or sequence of the ACK/NACK signal carried on a pair of slots.

HUAWEI-1005, 12:28-60.

164. In view of the above disclosure of KwakPat883, especially the emphasis that, by **“transmit[ing] modulation symbols for the ACK/NACK signal through the scheduling request channel,” “existing resources can be utilized without having to reserve additional resources,” “resource efficiency can be enhanced”** and the distinction from the other case of transmitting **“additional 1-bit information” “through QPSK modulation when the ACK/NACK signal is 1 bit”**, a POSITA would have understood that and found it readily obvious that there is no need to specify a

separate modulation or multiplexing operation used for transmission of the acknowledgement data with the scheduling request. KwakPat883's such disclosure further corroborates the plain explanation from KwakProv812. *See* HUAWEI-1005, 12:28-60; HUAWEI-1007, 59:16-20.

Z. [44] *“The method of claim 43, comprising: transmitting the acknowledgment with the scheduling request on the scheduling resource.”*

165. *See* Section XI, [1D] and [2], *supra*.

AA. [45] *“The method of claim 41, where the transmitting is on a physical uplink control channel.”*

166. *See* Section XI, [1B] and [5], *supra*.

XII. Application of LGE to the Challenged Claims of the ‘688 Patent

A. Overview of LGE

167. LGE is a 3GPP publication for LTE standard publically available by Aug. 20-24, 2007. *See* HUAWEI-1013, p.1. LGE was proposed by the very assignee of KwakPat883. *See id.* Similar to KwakPat883, LGE also discloses the same subject matter of the ‘688 Patent on multiplexing of uplink control signals, such as, “simultaneous transmission with ACK/NAK or CQI is required when SR is to be transmitted.” HUAWEI-1013, p.1.

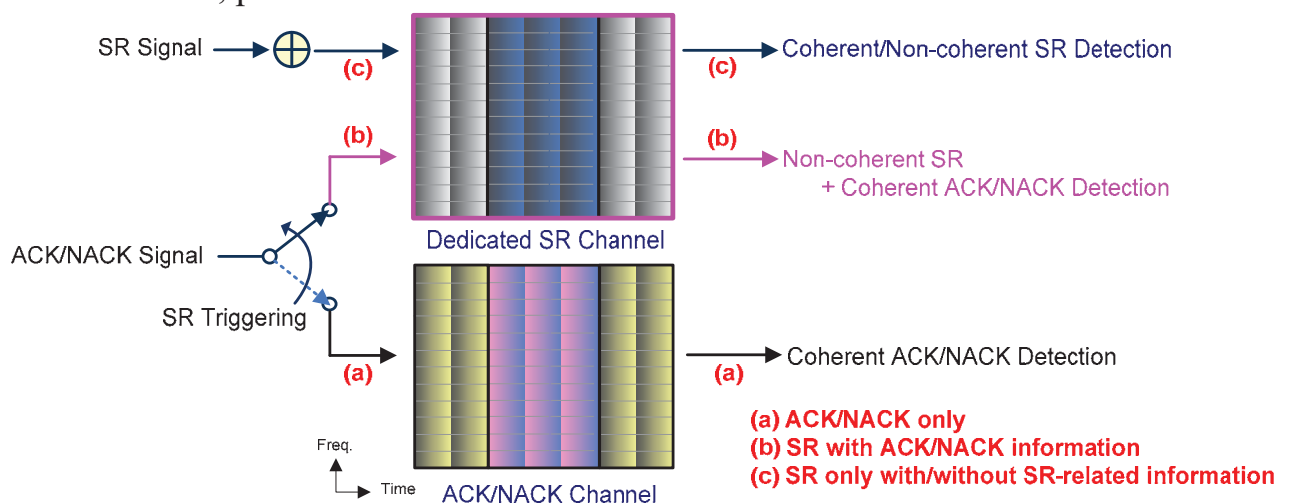
168. LGE proposed two schemes for addressing the “situations where simultaneous transmission with ACK/NAK or CQI is required when SR is to be transmitted.” HUAWEI-1013, p.1. The scheme “‘Alternative 2’ makes it possible for UEs

to transmit SR and ACK/NACK simultaneously in one subframe.” HUAWEI-1013, p.1.

169. Notably, LGE’s “Alternative 2” is similar, if not identical, to Kwak-Pat883’s scheme for simultaneous transmission of SR and ACK/NACK. This is not particularly surprising since the KwakPat883 is a patent of LG Electronics Inc. For example, LGE also discloses three scenarios, denoted as (a), (b) and (c) as shown in FIG.5 (reproduced below):

Figure 5 shows the exemplary operation how to transmit SR and/or ACK/NACK signal with ‘Alternative 2’ proposal. As can be seen in the figure, **two separate channels** will be utilized by one UE in order to transmit **either one of SR or ACK/NACK signal without multiplexing at a given time**. ...However, when the UE should transmit its SR and ACK/NACK signal simultaneously, the **ACK/NACK information is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5)....** In case of **SR-only transmission ((c) in Figure 2/sic/)**, the SR can be allocated to the dedicated SR channel and detected in a non-coherent or coherent manner...

HUAWEI-1013, p.5.



170. LGE, FIG.5.

B. [1A]: “A method comprising”

171. LGE discloses “2. Proposed Scheduling Request (SR) structure and operational **method**.” HUAWEI-1013,p.1.

C. [1B] “determining that an acknowledgment is to be sent on a physical uplink control channel,”

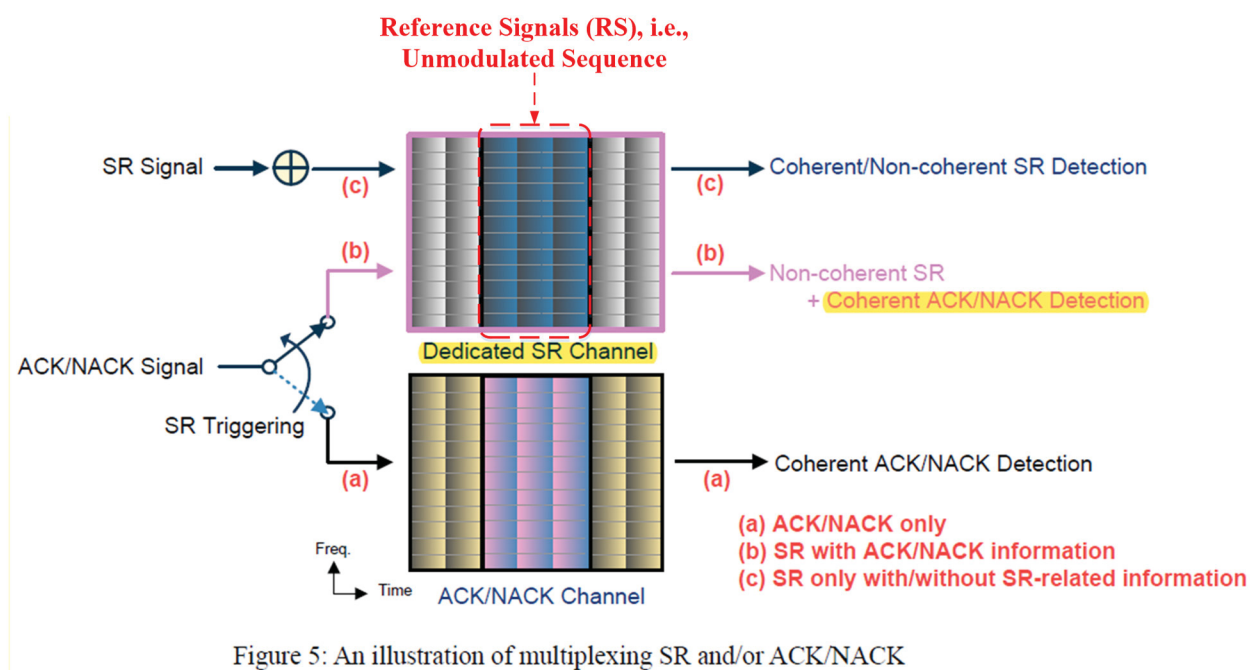
172. LGE discloses “[i]n **order to transmit** the SR and **ACK/NACK** simultaneously at the same subframe,” (HUAWEI-1013, p.5) and the **SR is transmitted on PUCCH**, (see “Proposed Scheduling Request (SR) structure and multiplexing with PUCCH,” HUAWEI-1013, Title). Accordingly, LGE discloses determining an acknowledgment (i.e., **ACK/NACK**) is to be sent on the PUCCH.

D. [1C] “where transmission of the acknowledgement on the physical uplink control channel comprises in addition to the acknowledgement data, a sequence that is unmodulated via a modulation scheme used for the acknowledgement data;”

173. LGE discloses that transmission of the acknowledgement comprises reference signals (RS) in addition to the acknowledgement data (i.e., ACK/NACK signal) by disclosing that coherent detection is used to detect the ACK/NACK: “when the UE should transmit its SR and ACK/NACK signal simultaneously, the ACK/NACK information is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5). In this case, ... **ACK/NACK information is obtained by coherent detection.**” HUAWEI-1013, p.5. Not only a POSITA

would readily understand that coherent detection of the ACK/NACK requires reference signals (RS) to be transmitted with the ACK/NACK, but also the ‘688 Patent admits that it had been known that acknowledgment data (e.g., ACK/NACK signals) are transmitted with reference signals, and the reference signals are unmodulated sequences. *See* Section VIII-D, *supra*.

174. In fact, LGE shows the reference signals (i.e., unmodulated sequence) in addition to the ACK/NACK signal in FIG.5 (annotated below) for “Coherent ACK/NACK Detection.” HUAWEI-1013, p.6.

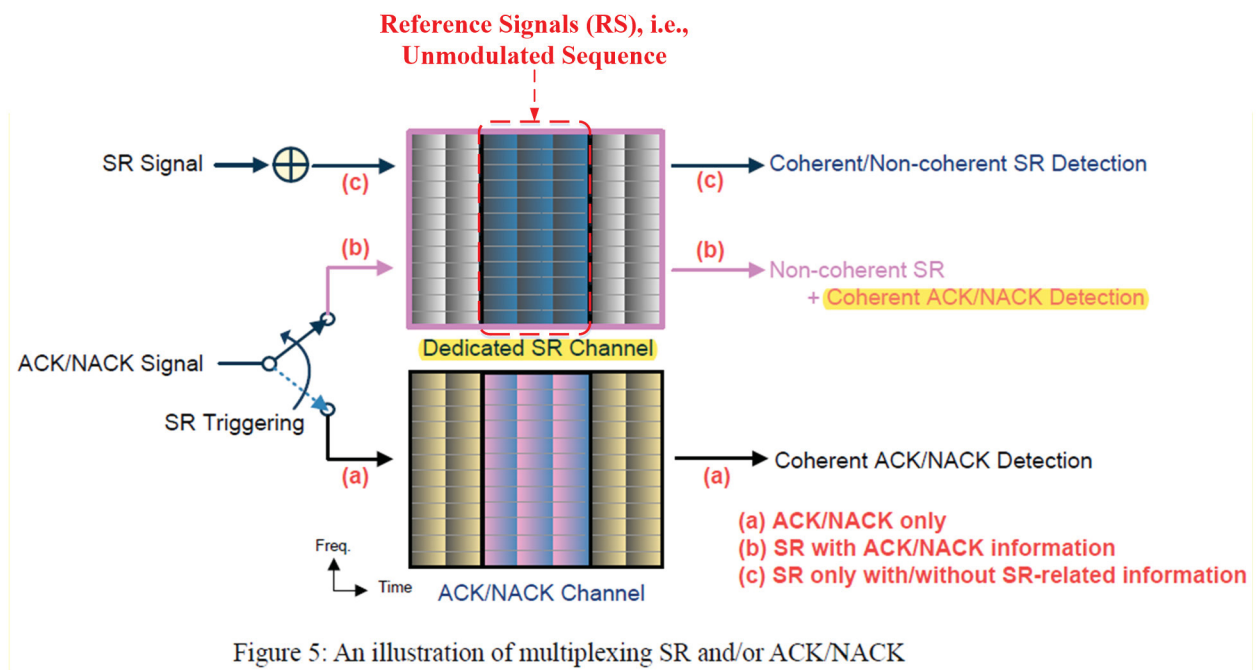


175. LGE, FIG.5 (annotated)

176. To the extent that one contends that LGE does not expressly disclose transmission of the acknowledgement comprises reference signals (RS) (i.e., *an unmodulated sequence*) in addition to the acknowledgement data, in view of LGE’s

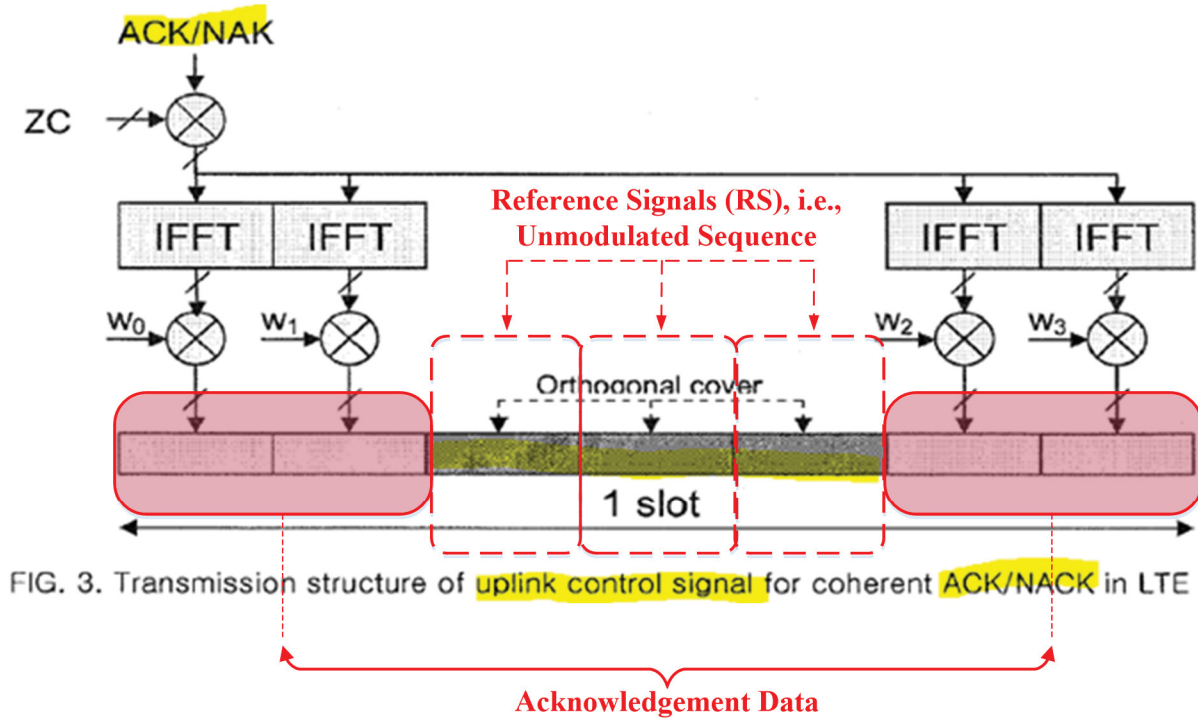
emphasis of coherent detection of ACK/NACK information (*see e.g.*, “**ACK/NACK information is obtained by coherent detection**,” HUAWEI-1013, p.5, and “eNB should perform **coherent demodulation for ACK/NACK**,” HUAWEI-1013, p.6), a POSITA would have it found obvious that the transmission of the acknowledgement, as taught by LGE, includes reference signals (RS) in addition to the acknowledgement data due to the very nature of coherent detection. *See* prior discussion that coherent detection of ACK/NACK data necessitates reference signals to be transmitted together with the ACK/NACK data for detecting the ACK/NACK data in Section VIII-D, *supra*. Such a recognition is well-known to a POSITA, especially in the field of wireless communications. *See e.g.*, HUAWEI-1018, 1:44-50. In fact, it had been known that “[c]oherent detection... is preferable ... to non-coherent detection” because it can achieve more reliable detection. HUAWEI-1018, 1:37-42. “Thus, **coherent** rather than non-coherent **detection is typically the preferred choice**.” *See* HUAWEI-1018, 1:42-44.

177. Moreover, LGE expressly specifies “Coherent ACK/NACK Detection” in path (b) of the below annotated FIG.5, where the UE transmits its SR and ACK/NACK signal simultaneously over the “Dedicated SR Channel.” HUAWEI-1013, p.5. LGE further explains that the “Dedicated SR Channel” has “the same slot format as for ACK/NACK [channel]”: the “Dedicated SR Channel” “reuse[s] the CDM-based structure of ACK/NACK channel....” HUAWEI-1013, p.5.



178. LGE, FIG.5 (annotated)

179. It had been known and acknowledged by the ‘688 Patent that in LTE ACK/NACK signals are transmitted based on **coherent** demodulation (see HUAWEI-1001 at 2:5-6) and the ACK/NACK channel for coherent ACK/NACK detection in LTE includes 3 symbols of RS. See, for example, FIG.3 of KwakProv812 (reproduced below with annotations) that shows transmission of the acknowledgement that includes reference signals and ACK/NACK data: “the **existing channel for transmitting the ACK/NACK control signal...having a length of 4 (for short CP) for the ACK/NACK data or orthogonal codes having a length of 3 for RS in the time domain.**” HUAWEI-1007, 52:23-26.

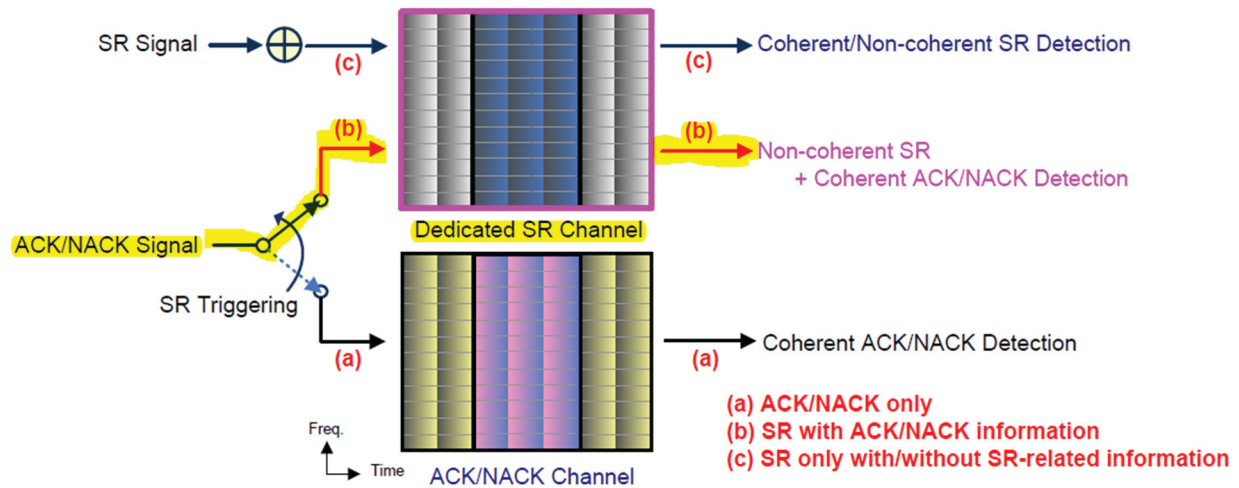


180. KwakProv812, FIG.3 (annotated)

181. Accordingly, a POSITA would have found it obvious that the transmission of the “ACK/NACK Signal” over the “Dedicated SR Channel” as disclosed by LGE would include the RS (i.e., unmodulated sequence) in addition to the ACK/NACK signal.

E. *[1D] “for a case where there is also a scheduling request to be sent, combining the acknowledgment with the scheduling request on a scheduling resource,”*

182. LGE discloses “when the UE should transmit its SR and ACK/NACK signal simultaneously, the ACK/NACK information is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5).” HUAWEI-1013, p.5.



183. LGE, FIG.5 (with highlighted Path (b))

F. [1E] “else placing the acknowledgment in another resource.”

184. As shown in highlighted FIG.5 below, LGE discloses, when there is not scheduling request to be sent (i.e., no “SR Triggering”), placing the acknowledgment in another resource (i.e., “ACK/NACK channel”): “two separate channels will be utilized by one UE in order to transmit either one of SR or ACK/NACK signal without multiplexing at a given time.” HUAWEI-1013, p.5.

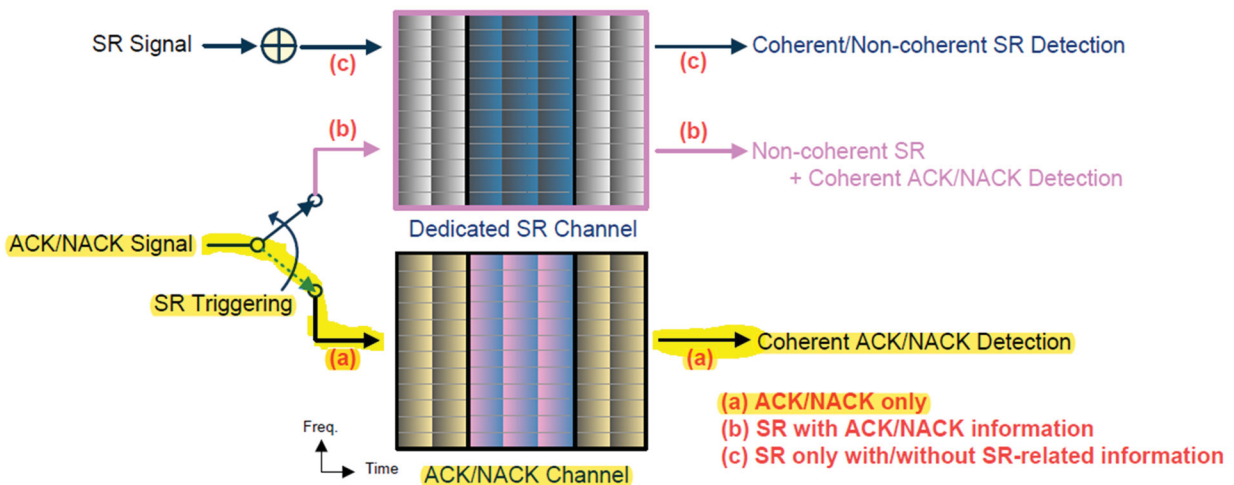


Figure 5: An illustration of multiplexing SR and/or ACK/NACK

185. LGE, FIG.5 (with highlighted Path (a))

G. *[2] “The method of claim 1, comprising: for the case where there is also the scheduling request to be sent, transmitting the acknowledgment with the scheduling request on the scheduling resource.*

186. LGE discloses “**when the UE should transmit its SR and ACK/NACK signal simultaneously, the ACK/NACK information is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5).**” HUAWEI-1013, p.5.

H. *[3] “The method of claim 1, comprising: for a case where a channel quality indicator is also to be sent, the channel quality indicator is not sent and the another resource is unused.”*

187. LGE makes clear that “in case of ‘Alternative 2’ structure” (i.e., for simultaneous transmission of SR and ACK/NACK), **when a channel quality indicator is also to be sent, “the same operational method as described in section 2.1.3 can be exploited when considering the multiplexing with CQI signal also in case of ‘Alternative 2’ structure. Hence, CQI is skipped or delayed (depending on CQI schemes) when CQI and SR transmission timing is overlapped as shown in Figure 4.**” HUAWEI-1013, p.5. Accordingly, LGE discloses *the channel quality indicator is not sent* in the ‘Alternative 2’ structure”:

2.1.3 Scheduling Request transmission in the presence of CQI transmission

From time to time, **SR transmission may happen to coincide with CQI transmission. If it happens, it seems to be reasonable that SR (with higher priority in most cases) is mainly transmitted instead of CQI.** We can also apply priority based selection method

when they coincide at the same time. **Figure 4 shows the exemplary case where CQI is skipped or delayed (depending on CQI schemes) when CQI transmission was scheduled at the same time when UE tries to transmit SR to eNB.**

HUAWEI-1013, p.5.

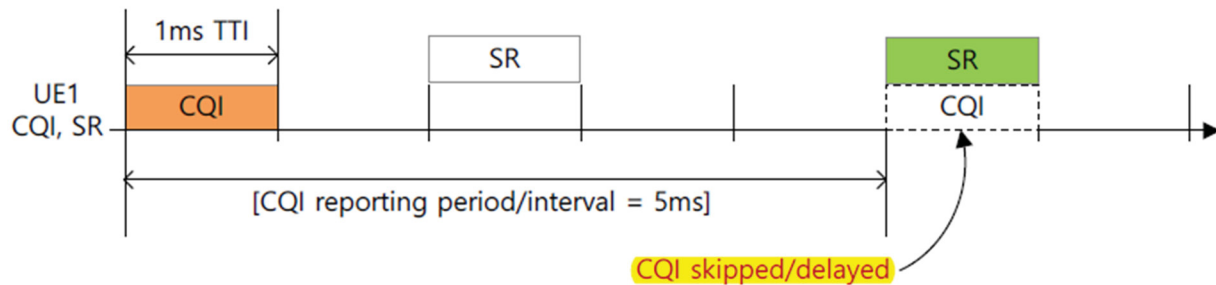
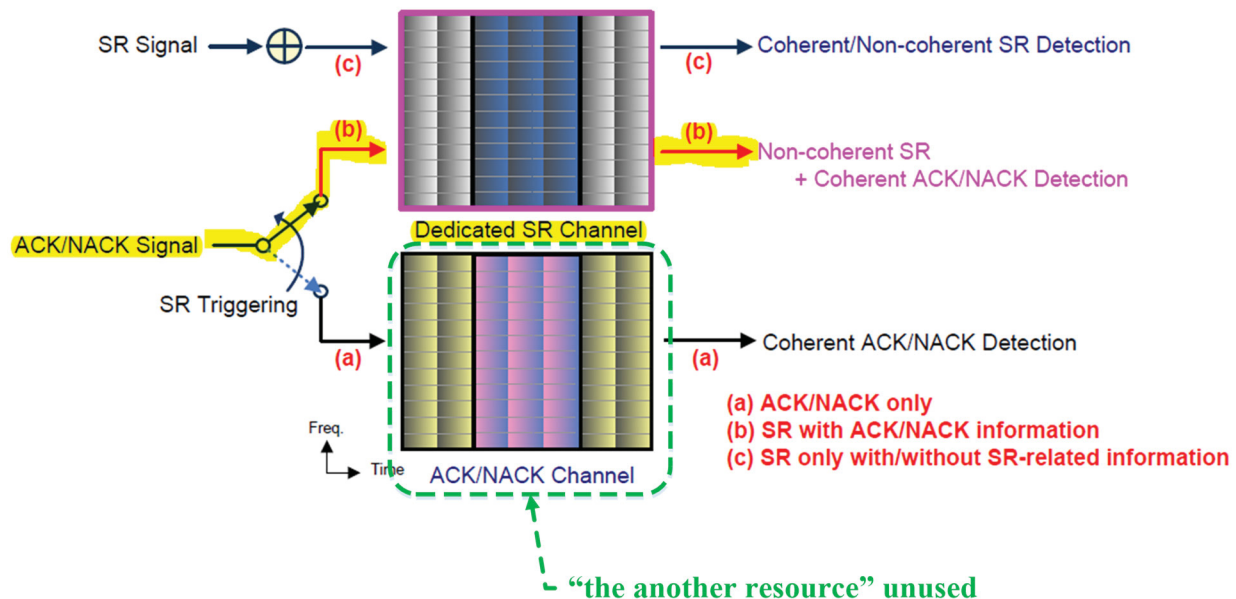


Figure 4: SR transmission when CQI is scheduled to be transmitted

188. LGE, FIG.4 (highlighted)

189. LGE also discloses *the another resource* (“**common resource for ACK/NACK signal,**” “**ACK/NACK channel**” in FIG.5) *is unused*: as shown in Figure 5, “**two separate channels** will be utilized by one UE in order **to transmit either one of SR or ACK/NACK signal** without multiplexing at a given time.” The separate ACK/NACK channel **is unused** “[i]f SR transmission from certain UE happens to coincide with its ACK/NACK signal transmission at the same subframe, **ACK/NACK signal** for this UE **should be diverted** to the dedicated resource which is assigned to the UE for SR transmission **from common resource for ACK/NACK signal** as shown in figure 5. However, when the UE should transmit its SR and

ACK/NACK signal simultaneously, **the ACK/NACK information is not transmitted on the ACK/NACK channel**, but on the dedicated SR channel ((b) in Figure 5).” HUAWEI-1013, p.5.



190. LGE, FIG.5 (annotated)

I. [4] *“The method of claim 1, where the another resource is a data-non-associated resource.”*

191. The ‘688 Patent identifies “data-non-associated (DNA) resources, such as ACK/NACK PUCCH,” HUAWEI-1001 6:38-43.

192. LGE discloses that another resource is “ACK/NACK channel,” *see* Section XII, [1E], and the ACK/NACK channel is on PUCCH: “[t]his dedicated **SR channel** (i.e., ‘Alternative 2’)” “which **reuse** the CDM-based **structure of ACK/NACK channel**” and having “**the same slot format as for ACK/NACK transmission**” “**is fully compatible and co-existing with the PUCCH.**” HUAWEI-

1013, p.5. Accordingly, the ACK/NACK channel is also “**fully compatible and co-existing with the PUCCH.**” *Id.* See also the ‘688 Patent’s admitted prior art that “[D]ata-non-associated control signals (e.g., ACK/NACK, periodic CQI) are transmitted on a **PUCCH.**” HUAWEI-1001, 2:3-5.

J. [5] “The method of claim 2, where the transmitting is on a physical uplink control channel.”

193. “The transmitting” refers to the “transmitting the acknowledgment with the scheduling request on the scheduling resource” as recited in claim 2.

194. LGE discloses “when the UE should transmit its SR and ACK/NACK signal simultaneously, **the ACK/NACK information is transmitted ... on the dedicated SR channel ((b) in Figure 5).**” HUAWEI-1013, p.5. LGE further discloses that “[t]his **dedicated SR channel** (i.e., ‘Alternative 2’) **is fully compatible and co-existing with the PUCCH.**” *Id.*

K. [6] “The method of claim 2, where the transmitting is on an uplink.”

195. LGE discloses that the transmitting is on an uplink by disclosing that the transmitting is on a physical **uplink** control channel by a UE. See Section XII, [5].

196. Additionally, LGE makes clear that “[t]his approach is appropriate for maintaining the single-carrier property for **UL transmission** while supporting the simultaneous transmission of SR and ACK/NACK.” HUAWEI-1013, p.6.

- L. [7A] “The method of claim 1, where the physical uplink control channel comprises an unmodulated sequence, where the unmodulated sequence comprises reference signals and”**

197. As discussed in Section IX of this Declaration, “a sequence that is unmodulated via a modulation scheme used for the acknowledgement data” encompasses “an unmodulated sequence,” and the “unmodulated sequence” further encompasses reference signals (RS). LGE discloses that transmission of the acknowledgement comprises reference signals, *see* Section XII, [1C]. *See also* the ‘688 Patent’s admitted prior art teaching that the reference signals are unmodulated sequences in Section VIII-D.

- M. [7B] “the acknowledgement data comprises a BPSK/QPSK modulated sequence.”**

198. The phrase “BPSK/QPSK” should refer to “BPSK or QPSK” given that BPSK and QPSK are alternative modulation schemes for 1 bit or 2 bits of information, which is acknowledged by the ‘688 Patent: “BPSK is used for 1-bit ACK/NACK and QPSK for 2-bit ACK/NACK.” HUAWEI-1001, 2:8-9.

199. LGE discloses the ACK/NACK comprises a modulated sequence: “eNB should perform **coherent demodulation for ACK/NACK,**” i.e., “**ACK/NACK** information is obtained by **coherent detection.**” HUAWEI-1013, p.5-6. The ‘688 Patent expressly admitted that it had been agreed in the LTE Standard that “BPSK is used for 1-bit ACK/NACK and QPSK for 2-bit ACK/NACK,”

HUAWEI-1001, 2:4-7. LGE is a 3GPP publication proposing discloses its techniques being used in an LTE standard system. Accordingly, a POSITA reviewing LGE would understand that BPSK or QPSK would be used for modulation when applying LGE's techniques. *See* HUAWEI-1013, p.1. Therefore, LGE discloses that the acknowledgement data comprises a BPSK/QPSK modulated sequence. *See also* the '688 Patent's admitted prior art teaching that acknowledgment data (e.g., ACK/NACK signals) includes a modulated BPSK or QPSK sequence. Section VIII-C, *supra*.

N. [8] “The method of claim 1 implemented in a wireless communications network.”

200. LGE, a 3GPP publication, is entitled “Proposed Scheduling Request (SR) structure and multiplexing with PUCCH [of LTE]”. HUAWEI-1013, p.1. The '688 Patent admitted in the Background Section, particularly among the abbreviations, that “The 3GPP has been working on the standardization of LTE [long term evolution of UTRAN (E-UTRAN)],” where “E-UTRAN” stands for “evolved universal terrestrial radio access network [i.e., a wireless communication system].” HUAWEI-1001 2: 1-2; 1:46-47. Accordingly, LGE discloses the method of claim 1 is implemented in a wireless communication system.

O. [9] “The method of claim 1 implemented in an evolved universal terrestrial radio access network.”

201. LGE is a publication of 3GPP (third generation partnership project), the organization that “has been working on the standardization of LTE (E-UTRAN).” See HUAWEI-1001, 2:1-2; 1: 46-47 and 65. LGE is entitled “Proposed Scheduling Request (SR) structure and multiplexing with PUCCH [of LTE].” HUAWEI-1013, p.1.

202. As admitted by the ‘688 Patent and obvious to a POSITA that LTE is “long term evolution of UTRAN (E-UTRAN)” and “E-UTRAN” stands for “evolved universal terrestrial radio access network.” HUAWEI-1001, 1:46-47. See Section VIII-A of this Declaration. Accordingly, a POSITA would readily understand that LGE discloses that the method of claim 1 is implemented in an E-UTRAN.

P. [37A] “A method comprising:”

203. See Section XII, [1A], *supra*.

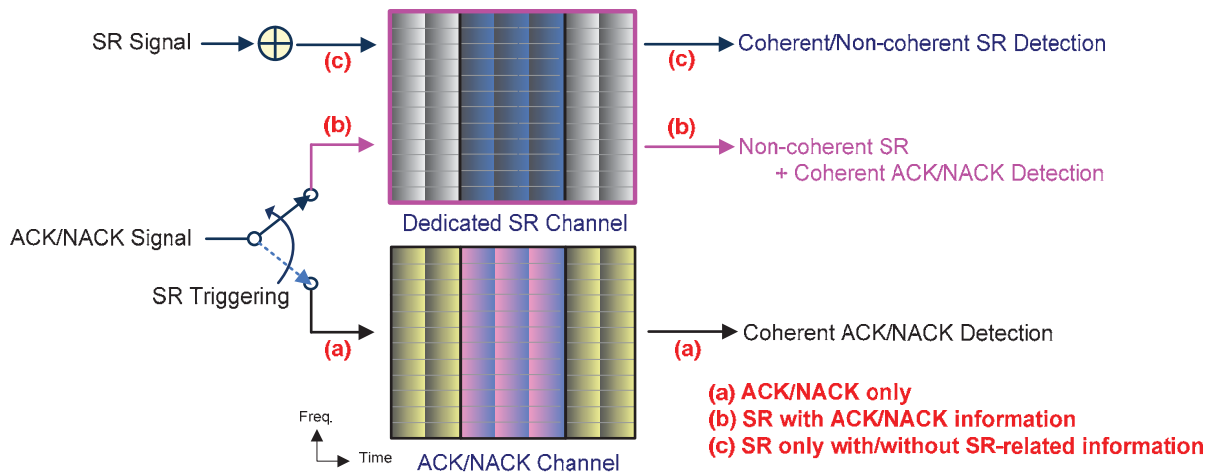
Q. [37B] “determining that a scheduling request resource and at least one other resource are reserved for a user equipment in a same subframe; and”

204. LGE makes clear that a “Dedicated SR channel” (i.e., a scheduling request resource) and an “ACK/NACK Channel” (i.e., at least one other resource) are reserved for a user equipment in a same subframe by disclosing that: 1) the two separate channels are reserved; 2) the “dedicated SR channel is configured “to transmit the SR and ACK/NACK simultaneously **at the same subframe,**” and 3) “eNB

is required to **monitor both SR channel and ACK/NACK channel at the same time**”:

As can be seen in the figure [Figure 5], **two separate channels will be utilized by one UE** in order to transmit either one of SR or ACK/NACK signal without multiplexing at a given time. In other words, **if SR transmission from certain UE happens to coincide with its ACK/NACK signal transmission at the same subframe**, ACK/NACK signal for this UE should be diverted to the **dedicated resource** which is assigned to the UE for SR transmission from **common resource for ACK/NACK signal** as shown in figure 5. However, when the UE should transmit its SR and ACK/NACK signal simultaneously, the ACK/NACK information is not transmitted on the ACK/NACK channel, but **on the dedicated SR channel ((b) in Figure 5)**. ... In case of SR-only transmission ((c) in Figure 2), the SR can be allocated to the dedicated SR channel and detected in a non-coherent or coherent manner. In order to support this operation, **eNB is required to monitor both SR channel and ACK/NACK channel at the same time**.

HUAWEI-1013, p.5-6.

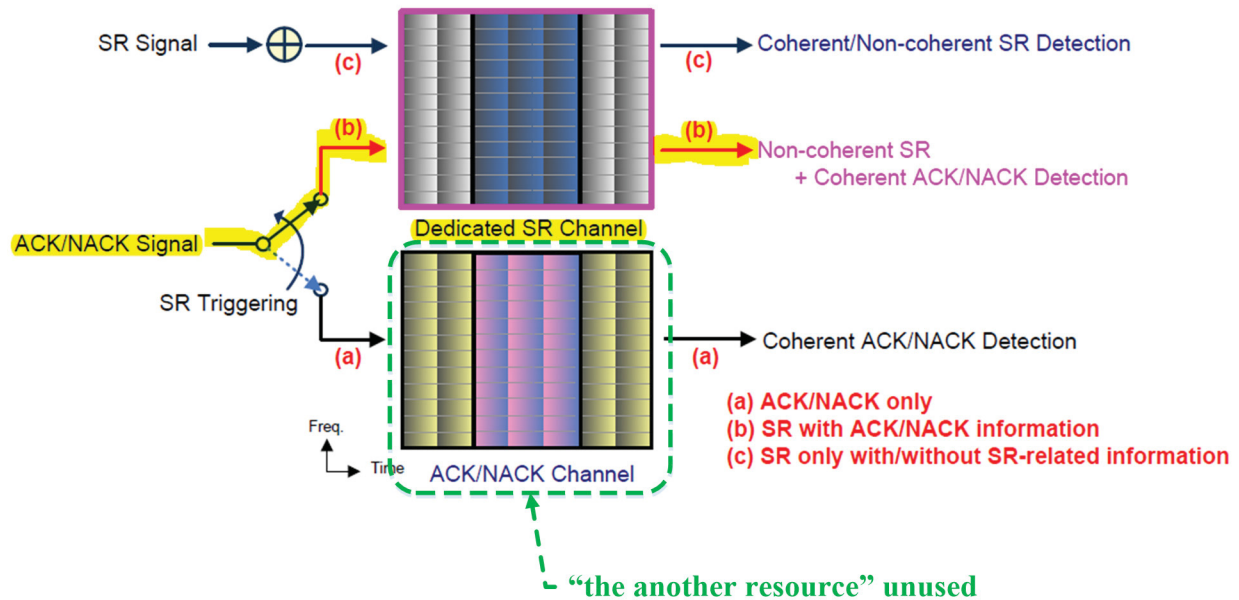


205. LGE, FIG. 5

- R.** [37C] “based on whether a scheduling request is desired to be transmitted by the user equipment, placing at least one of an acknowledgment/negative acknowledgement and a channel quality indicator

that is desired to be transmitted by the user equipment in one of the resources and leaving at least one other resource unused,”

206. LGE discloses based on that a scheduling request is desired to be transmitted by the user equipment, it triggers placing ACK/NACK signal (i.e., at least one of an acknowledgment/negative acknowledgement and a channel quality indicator) that is desired to be transmitted by the user equipment in one of the resources (i.e., **“dedicated resource,”** “Dedicated SR Channel” in FIG.5) according to Path (b) (“ACK/NACK signal for this UE should be **diverted to the dedicated resource** which is **assigned to the UE for SR transmission from common resource for ACK/NACK signal** as shown in figure 5), thus leaving at least one other resource (e.g., **“common resource for ACK/NACK signal,”** “ACK/NACK channel” in FIG.5) in Path (a) unused: “when the UE should transmit its SR and ACK/NACK signal simultaneously, the ACK/NACK information **is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5).**” HUAWEI-1013, p.5. *See also* footnote 4 of this Declaration.



207. LGE, FIG.5 (annotated)

S. [37D] “where the transmission is to comprise an unmodulated sequence in addition to the acknowledgement data.”

208. See Section XII, [1C], *supra*.

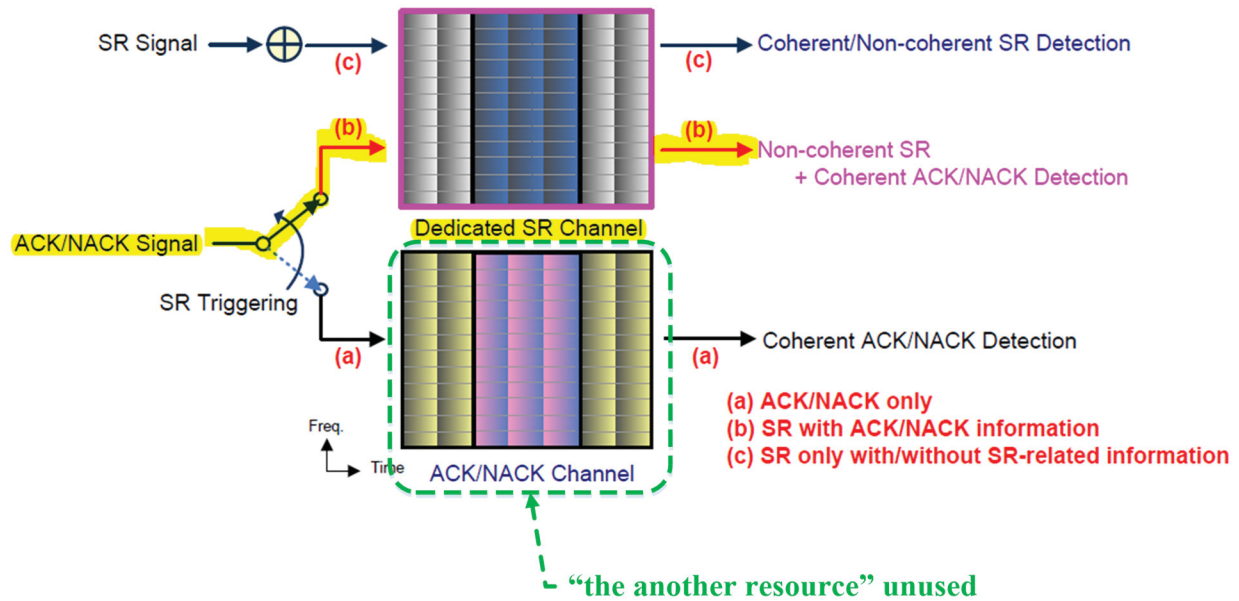
T. [38] “The method of claim 37, where the scheduling request resource and the at least one other resource are physical uplink control channel resources.”

209. See Section XII, [1B] and [5], *supra*.

U. [39A] “The method of claim 37 comprising: for a case where the user equipment desires to transmit a scheduling request and transmit an acknowledgment/negative acknowledgement, transmitting the acknowledgment/negative acknowledgement with the scheduling request on the scheduling request resource and leaving the at least one other resource unused.”

210. LGE discloses “when the UE should transmit its SR and ACK/NACK signal simultaneously,” (i.e., for a case where the user equipment desires to transmit a scheduling request and transmit an acknowledgment/negative acknowledgement),

“the ACK/NACK information is **not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5)**” (i.e., *transmitting the acknowledgment/negative acknowledgement with the scheduling request on the scheduling request resource and leaving the at least one other resource unused*). HUAWEI-1013, p.5.



211. LGE, FIG.5 (annotated)

V. [39B] “or for a case where the user equipment does not desire to transmit a scheduling request and does desire to transmit an acknowledgment/negative acknowledgement, transmitting the acknowledgment/negative acknowledgement on the at least one other resource and leaving the scheduling request resource unused.”

212. Note that claim 39 recites claim element [39A] “or” claim element [39B]. LGE thus satisfies claim 39 already by disclosing claim element [39A] as

described above. Moreover, LGE also discloses claim element [39B] as discussed below.

213. LGE discloses where the user equipment does not desire to transmit a scheduling request (i.e., no “SR Triggering”) and does desire to transmit an acknowledgment/negative acknowledgement (i.e., ACK/NACK), transmitting the acknowledgment/negative acknowledgement on the at least one other resource (e.g., “common resource for ACK/NACK signal,” “ACK/NACK channel” in FIG.5) in Path (a), thus leaving the scheduling request resource (i.e., “dedicated resource,” “Dedicated SR Channel” in FIG.5) in Path (b) unused: **“two separate channels will be utilized by one UE in order to transmit either one of SR or ACK/NACK signal without multiplexing at a given time,”** in contrast to the scenario “if SR transmission from certain UE happens to coincide with its ACK/NACK signal transmission at the same subframe, ACK/NACK signal for this UE should be **diverted to the dedicated resource** which is assigned to the UE **for SR transmission from common resource for ACK/NACK signal** as shown in figure 5.” HUAWEI-1013, p.5.

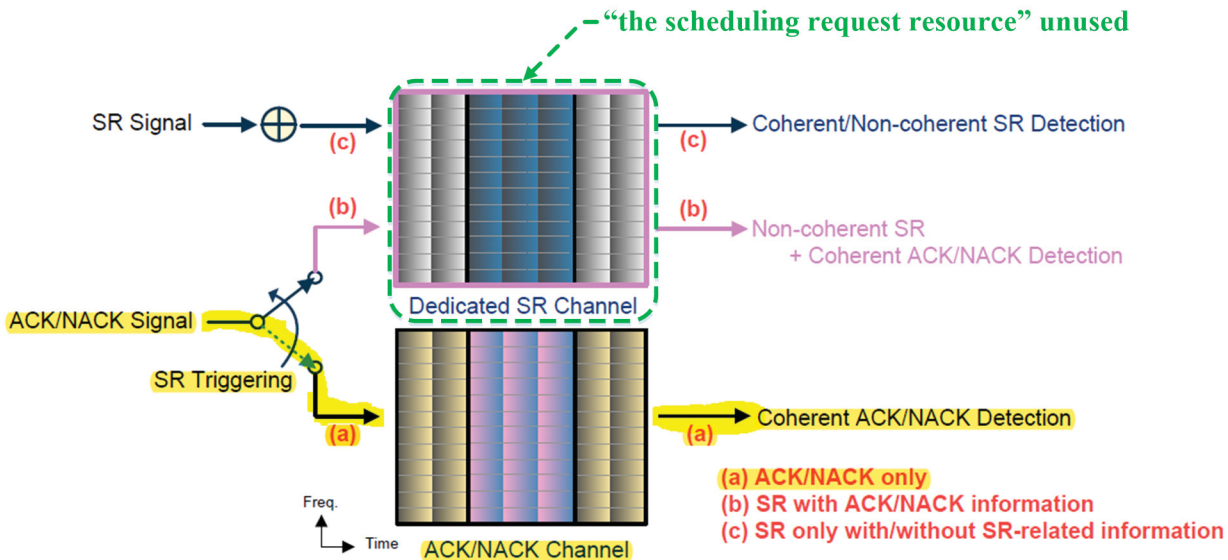


Figure 5: An illustration of multiplexing SR and/or ACK/NACK

214. LGE, FIG.5 (annotated)

W. [40] *“The method of claim 37 comprising: for a case where the user equipment desires to transmit a scheduling request and a channel quality indicator but no acknowledgment/negative acknowledgment, transmitting the scheduling request on the scheduling request resource and not transmitting the channel quality indicator leaving the at least one other resource unused.”*

215. See Section XII, [3] and [37A]-[37D], *supra*.

X. [42] *“The method of claim 37, where the scheduling request information is conveyed based on a selected physical uplink control channel selection.”*

216. As shown in below highlighted FIG.5, LGE discloses “SR triggering” causes the selection between “SR channel” and “ACK/NACK” channel, both of which are physical uplink control channels. See Section XII, [1B] [1D] and [5], *supra*. See also footnote 4 of this Declaration. LGE discloses that the SR information (e.g., whether a SR is presented or not based on energy detection) is conveyed based

on a selected physical uplink control channel selection (e.g., the SR channel in the case of Path (2) when the SR and the ACK/NACK signal are simultaneously transmitted):

when the UE should transmit its SR and ACK/NACK signal simultaneously, the ACK/NACK information is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5). In this case, the 1-bit **SR using on-off keying is detected non-coherently by means of energy detection** and then ACK/NACK information is obtained by coherent detection. In case of SR-only transmission ((c) in Figure 2), the SR can be allocated to the dedicated SR channel and detected in a non-coherent or coherent manner. In order to support this operation, eNB is required to monitor both SR channel and ACK/NACK channel at the same time. **If eNB detects certain level of energy on SR channel** at the time instant when ACK/NACK signal is expected from the UE, **eNB should perform coherent demodulation for ACK/NACK on the dedicated resource for SR, not on the common resource assigned for ACK/NACK transmission.**

HUAWEI-1013, pp.4-5.

217. Accordingly, the scheduling request information (e.g., whether a SR is presented or not) is conveyed based on a selected physical uplink control channel selection (e.g., either “SR channel” or “ACK/NACK” channel).

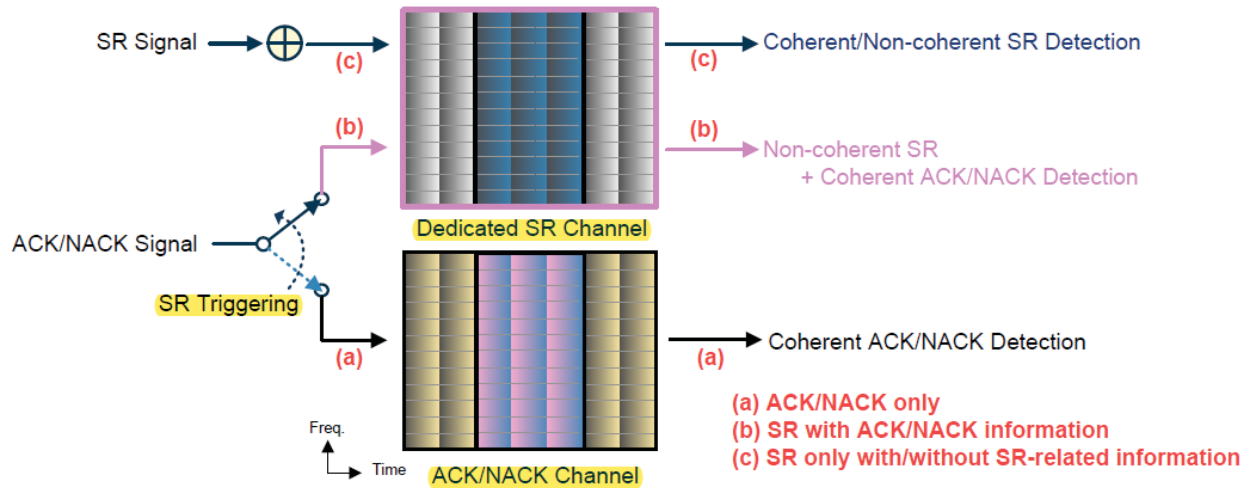


Figure 5: An illustration of multiplexing SR and/or ACK/NACK

218. LGE, FIG.5 (highlighted)

Y. [43A] *“A method comprising.”*

219. See Section XII, [1A], *supra*.

Z. [43B] *“determining that an acknowledgment transmission is to be sent.”*

220. See Section XII, [1B], *supra*.

AA. [43C] *“for a case where there is also a scheduling request to be sent, transmitting the acknowledgment data with the scheduling request on a scheduling resource in an uplink,*

221. See Section XII, [1D] and [2], *supra*.

BB. [43D] *“where there is no need to specify a separate modulation or multiplexing operation used for transmission of the acknowledgment data with the scheduling request, from a modulation or multiplexing operation used for transmission of the acknowledgement on another resource.”*

222. LGE also discloses this feature by distinguishing its “dedicated SR channel (i.e., ‘Alternative 2’)” from a scheme in its cited reference [2], R1-073011,

a 3GPP publication proposed by the Patent Owner on the same subject matter. HUAWEI-1017, p.1. Specifically, R1-073011 proposes the use of a separate modulation with an “increased modulation order” for “[m]ultiplexing of Scheduling Request and ACK/NACK and/or CQI” but admits at least the disadvantage that “Increasing the order of modulation will decrease the link performance.” HUAWEI-1017, pp.1-2. By contrast, LGE’s “dedicated SR channel (i.e., ‘Alternative 2’) is **fully compatible and co-existing with the PUCCH** in the same time-frequency resource,” and thus there is no need to specify a separate modulation used for transmission of the acknowledgement data with the scheduling request, from the one used for transmission of the acknowledgement on another resource. HUAWEI-1013, p.5; HUAWEI-1017, p.1.

CC. [44] “The method of claim 43, comprising: transmitting the acknowledgment with the scheduling request on the scheduling resource.”

223. See Section XII, [1D] and [2], *supra*.

DD. [45] “The method of claim 43, where the transmitting is on a physical uplink control channel.”

224. See Section XII, [1B] and [5], *supra*.

XIII. Application of KwakPat883 and LGE to the Challenged Claims of the ‘688 Patent

A. *Reasons a POSITA would have been led to combine KwakPat883 and LGE*

225. LGE, a 3GPP publication for LTE standard proposed by the very assignee of KwakPat883, is directed to the same field of endeavor as the ‘688 Patent. In fact, LGE shares very similar disclosure to KwakPat883 and also discloses the multiplexing of uplink control signals as the ‘688 Patent, such as, “simultaneous transmission with ACK/NAK or CQI is required when SR is to be transmitted,” HUAWEI-1013, p.1. *See e.g.*, HUAWEI-1005, FIG.9; HUAWEI-1007, FIG.7; and HUAWEI-1013, FIG.5.

226. In particular, KwakPat883 explains that its “invention provides a method of transmitting a plurality of **multiplexed uplink control signals**,” and “a method of **transmitting a scheduling request ... together with other control signals through one uplink control channel**.” HUAWEI-1005, 2:25-26, 2:27-30. KwakPat883 identifies that “the **control signal includes ... a channel quality indicator (CQI)**.” HUAWEI-1005, 5:49-50. KwakPat883 further makes clear that “**Although the ACK/NAK signal will be described hereinafter**, the scheduling request channel **can also be used for other control signals**.” HUAWEI-1005, 8:27-30.

227. KwakProv812 supports KwakPat883’s disclosure by explaining that its proposed **SR channel structure** “can be extended as a general SR channel configuration method irrespective of presence of an arbitrary control signal as long as it is **not limited to only the transmission simultaneous with a certain control signal such as the ACK/NACK signal.**” HUAWEI-1007, 52:17-20. KwakProv812 also identifies CQI is a control signal: “the existing **control signal** (ACK/NACK or **CQI**).” *Id.*

228. Complementing KwakPat883, LGE discloses how the scheduling request channel can also be used for other control signals, particularly, a channel quality indicator (CQI) by disclosing not only “Scheduling Request transmission in the presence of ACK/NACK” in a similar, if not identical, manner as described in KwakPat883, but also “Scheduling Request transmission **in the presence of CQI**” with specificity. HUAWEI-1013, §2.1.3.

229. I believe a POSITA would have been motivated to review and analyze publications on the same or similar subject matter (e.g., multiplexing SR and uplink control signals, particularly simultaneous transmitting SR and ACK/NACK on a scheduling resource) prepared or provided by the same entity (i.e., LG Electronics Inc.). A POSITA would have found KwakPat883 and LGE are combinable given at least the aforementioned substantially analogous disclosures between the two. In particular, a POSITA would have been motivated to combine them to explore the

capabilities of the KwakPat883 system to support simultaneous transmission of SR with another control signal, CQI, by applying LGE's teachings related to simultaneous transmission of SR with CQI, thereby, achieving the envisioned scope and capabilities of KwakPat883 system that are "not limited to only the transmission simultaneous with a certain control signal such as the ACK/NACK signal." See HUAWEI-1007, 52:19-20. Additional rationales for combining KwakPat883 and LGE are set forth below in connection with the discussion of specific claim elements.

B. [3] *"The method of claim 1, comprising: for a case where a channel quality indicator is also to be sent, the channel quality indicator is not sent and the another resource is unused."*

230. LGE makes clear that "in case of 'Alternative 2' structure" (i.e., for simultaneous transmission of SR and ACK/NACK), **when a channel quality indicator is also to be sent, "the same operational method as described in section 2.1.3 can be exploited when considering the multiplexing with CQI signal also in case of 'Alternative 2' structure. Hence, CQI is skipped or delayed (depending on CQI schemes) when CQI and SR transmission timing is overlapped as shown in Figure 4."** HUAWEI-1013, p.5. Accordingly, LGE discloses *the channel quality indicator is not sent* in the 'Alternative 2' structure":

2.1.4 Scheduling Request transmission in the presence of CQI transmission

From time to time, **SR transmission may happen to coincide with CQI transmission. If it happens,** it seems to be reasonable that **SR (with higher priority in most cases) is mainly transmitted instead of CQI.** We can also apply priority based selection method

when they coincide at the same time. **Figure 4 shows the exemplary case where CQI is skipped or delayed (depending on CQI schemes) when CQI transmission was scheduled at the same time when UE tries to transmit SR to eNB.**

HUAWEI-1013, p.5.

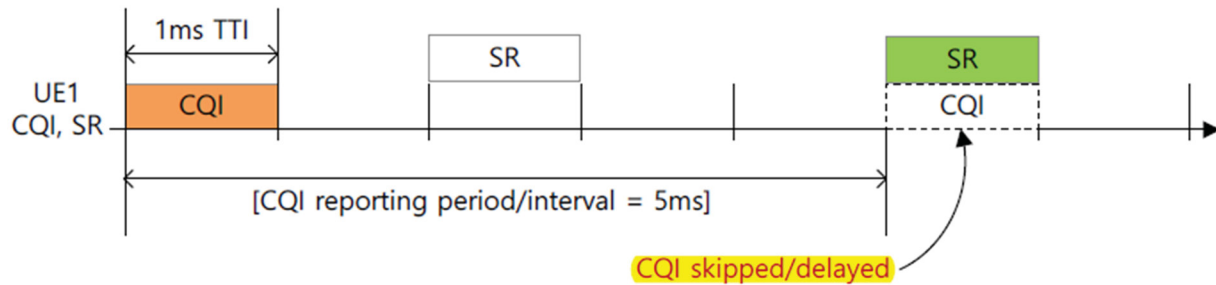
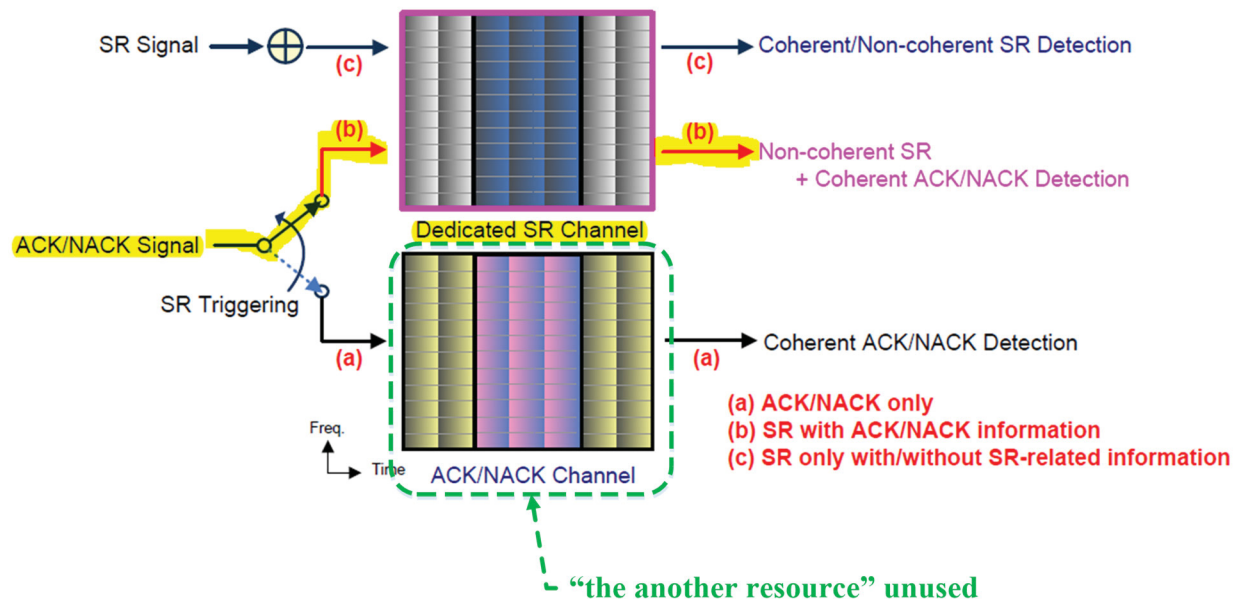


Figure 4: SR transmission when CQI is scheduled to be transmitted

231. LGE, FIG.4 (highlighted)

232. LGE also discloses *the another resource* (i.e., “an ACK/NACK channel which is configured by an ACK/NACK resource for the ACK/NACK signal”) *is unused*: as shown in Figure 5, “**two separate channels** will be utilized by one UE in order **to transmit either one of SR or ACK/NACK signal** without multiplexing at a given time.” The separate ACK/NACK channel **is unused**: “[i]f SR transmission from certain UE happens to coincide with its ACK/NACK signal transmission at the same subframe, **ACK/NACK signal** for this UE **should be diverted** to the dedicated resource which is assigned to the UE for SR transmission **from common resource for ACK/NACK signal** as shown in figure 5. However, **when the UE should trans-**

mit its SR and ACK/NACK signal simultaneously, the ACK/NACK information is not transmitted on the ACK/NACK channel, but on the dedicated SR channel ((b) in Figure 5).” HUAWEI-1013, p.5.



233. LGE, FIG.5 (annotated)

234. KwakPat883 discloses a system for uplink transmission having largely the same characteristics as the system disclosed by LGE; a POSITA reviewing the former would look to the latter for implementation details of specifics not covered in the former. *See e.g.*, HUAWEI-1005, FIG.9; HUAWEI-1007, FIG.7; and HUAWEI-1013, FIG.5 and FIG.4. In doing so, they would discover treatment of a common problem that occurs in such systems when transmission of an SR and a CQI happen to coincide. HUAWEI-1013, pp.5-6. A solution to this problem is proposed by LGE as being to simply skip or delay the CQI transmission. *Id.* A

POSITA reviewing KwakPat883 would anticipate a similar problem as potentially occurring in KwakPat883's system and would turn to LGE's teachings, which, after all, describe a system largely identical to the system of KwakPat883, to provide a solution to address the problem. *See e.g.*, HUAWEI-1005, FIG.9; HUAWEI-1007, FIG.7; and HUAWEI-1013, FIG.5.

235. Based on LGE's teachings, especially LGE's acknowledgement that its proposed solution of "multiplexing with CQI signal also applies to case of 'Alternative 2' structure" (i.e., for simultaneous transmission of SR and ACK/NACK), a POSITA would have found that the combined teachings of KwakPat883 and LGE make it plain that for a case where a channel quality indicator is also to be sent, the channel quality indicator is not sent and the another resource is unused "in case of 'Alternative 2' structure." *See* HUAWEI-1013, p.5 and FIG.4. Accordingly, KwakPat883 in view of LGE renders obvious claim 3.

C. [40] *"The method of claim 37 comprising: for a case where the user equipment desires to transmit a scheduling request and a channel quality indicator but no acknowledgment/negative acknowledgment, transmitting the scheduling request on the scheduling request resource and not transmitting the channel quality indicator leaving the at least one other resource unused."*

236. KwakPat883 in view of LGE renders obvious claim 37 for the same reasons discussed above in Section XI, [37A]-[37D] and Section XIII, [3].

XIV. Application of KwakPat883 and Bachl to the Challenged Claims of the ‘688 Patent

237. Claims 10, 11, 13-15, 17-24, and 46-48 are computer-readable medium and apparatus claims that recite similar, if not identical language to the method claims 1-2, 4-9, 37-40, and 42-45. As described in Section XI, KwakPat883 discloses an apparatus (e.g., UE) performing the recited operations of claims 1-2, 4-9, 37-40, and 42-45, and hence the recited operations of claims 10, 11, 13-15, 17-24, and 46-48. Particularly, KwakPat883 discloses that the apparatus (e.g., UE) including at least one “processor” and “memory,” or a “non-transitory computer readable medium” for performing the disclosed operations:

The present invention can be implemented with **hardware, software or combination** thereof. In hardware implementation, the present invention can be implemented with one of an application specific integrated circuit (ASIC), a digital signal processor (DSP), a programmable logic device (PLD), a field programmable gate array (FPGA), a **processor**, a controller, a microprocessor, other electronic units, and combination thereof, which are **designed to perform the aforementioned functions**. In software implementation, the present invention can be implemented with a module for performing the aforementioned functions. **Software is storable in a memory unit and executed by the processor. Various means** widely known to those skilled in the art **can be used as the memory unit or the processor**.

HUAWEI-1005, 17:19-32.

238. KwakProv812’s disclosure that UE performs the recited operations supports KwakPat883’s above disclosure of implementation details as a POSITA would have readily understood that a UE would have included at least one “proces-

sor,” “memory” or “non-transitory computer readable medium” to perform its disclosed functions given that such implementations are well known and common practice in the art. For example, in an analogous prior art reference, Zhang, relating to transmitting feedback (including a channel quality indicator and an acknowledgment/negative acknowledgement) by a user equipment in a wireless communication system (HUAWEI-1019, Abstract), discloses that “The **UE 502 includes a processor 510,**” HUAWEI-1019, [0073] and methods performed by a UE are implemented with “memory” or “non-transitory computer readable medium”:

The **methods** or flow charts provided in the present invention **may be implemented** in a **computer program**, software, or firmware tangibly embodied in a **computer-readable storage medium** for execution by a general purpose computer or a processor. Examples of **computer-readable storage mediums include** a read only **memory** (ROM), a random access **memory** (RAM), a register, cache memory, semiconductor memory devices[.]
HUAWEI-1019, [0075].

239. Therefore, it would have been obvious to a POSITA that the UE disclosed by KwakPat883 would have included at least one “processor,” “memory” or “non-transitory computer readable medium” to perform its disclosed method and thus render obvious claims 10, 11, 13-15, 17-24, and 46-48 because such implementations of a UE would have been well within the knowledge and capabilities of a skilled artisan.

240. However, to the extent that Patent Owner argues that a UE would not have included at least one “processor” and “memory” to perform its disclosed functions because KwakProv812 does not expressly disclose such a feature (despite KwakPat883 does expressly disclose so), Bachl is used as a supporting reference to show that, by the time of the earliest possible priority date of the ‘688 Patent, it had been well-known in the art that a UE would have included at least one “processor,” “memory” or “non-transitory computer readable medium” for its disclosed functions.

A. *Reasons to Combine KwakPat883 with Bachl*

241. Similar to KwakPat883, Bachl also discloses “methods are provided for transmitting scheduling requests over uplink channels.” HUAWEI-1011, Abstract. Both KwakPat883 and Bachl relates to “wireless communication systems,” particularly, LTE systems. *See e.g.*, HUAWEI-1005, 2:34-3:8; HUAWEI-1007, 49:2-21; HUAWEI-1011, [0002], [0007] and [0008]. Both references solve the same problems of simultaneous transmission of SR and other uplink control signals including ACK/NACK. *See e.g.*, HUAWEI-1005, 7:28-43; 12:19-27; HUAWEI-1007, 51:9-11; HUAWEI-1011, [0011]-[0013]. A POSITA seeking to implement a system based on KwakPat883 would have been led to Bachl to identify a specific configuration of a UE that would have the capabilities to implement the techniques of KwakPat883. In doing so, they would recognize that it is a known, common practice in the

art that the disclosed operations of the UE (e.g., for “transmitting scheduling requests over uplink channels,” (see HUAWEI-1011, Abstract; HUAWEI-1005, 3:2-21; HUAWEI-1007, 50:7-10;)) could be software implemented by a computer system or electronic device (i.e., an apparatus) that includes a “processing unit,” “memory” and “program storage medium” in view of Bachl’s explanation:

terms such as **“processing” or “computing” or “calculating” or “determining” or “displaying” or the like, refer to the action and processes of a computer system, or similar electronic computing device**, that manipulates and transforms data represented as physical, electronic quantities within **the computer system’s registers and memories** into other data similarly represented as physical quantities within the **computer system memories** or registers **or other such information storage**, transmission or display devices.

Note also that the **software implemented** aspects of the invention are typically encoded on some form of **program storage medium** or implemented over some type of transmission medium. The program storage medium may be magnetic (e.g., a floppy disk or a hard drive) or optical (e.g., a compact disk read only **memory**, or “CD ROM”), and may be read only or random access. Similarly, the transmission medium may be twisted wire pairs, coaxial cable, optical fiber, or some other suitable transmission medium known to the art. The invention is not limited by these aspects of any given implementation.

HUAWEI-1011, [0023], [0024].

242. Bachl further specifies that “[a] “mobile unit” (“such as ... user equipment”) includes “a processing unit” configured to perform the disclosed operations of the UE (“determine ...; and encode...”). See HUAWEI-1011, [0004], claim 22.

243. As such, in view of Bachl, a POSITA would have readily recognized that the UE disclosed by KwakProv812 as incorporated by reference into KwakPat883 could be implemented through use of at least one “processing unit” (i.e., processor), “memory,” or “program storage medium” (i.e., non-transitory computer readable medium) for performing the disclosed operations that satisfy claims 10, 11, 13-15, 17-24, and 46-48, which is further corroborated by KwakPat883’s express disclosure. HUAWEI-1005, 17:19-32. I believe such a recognition would have directly followed from a POSITA’s common-sense knowledge because it is a well-known, routine practice in the art to use a device that has a “processing unit” and a “memory” when the device, like that disclosed in KwakProv812, is required to execute techniques that require processing and storage of data. Moreover, it is a well-known and routine practice in the art to implement such techniques in software and, hence, via the “processing unit” executing a program accessed from a “program storage medium.” *See e.g.*, HUAWEI-1019, [0073], [0075]. Indeed, use of a “processor,” “memory” and a “program storage medium” in the UE of KwakProv812 would have been an implementation of a known technique or device for its ordinary purposes in the same way as has already been disclosed for similar devices (i.e., Bachl’s “mobile unit...such as ... user equipment”) versus KwakProv812’s UE) to achieve a predictable result (e.g., transmitting scheduling requests over uplink channels, particularly, addressing the same problems of simultaneous transmission of SR and

other uplink control signals including ACK/NACK). *See e.g.*, HUAWEI-1011, Abstract, [0011]-[0013]; HUAWEI-1005, 17:19-32; HUAWEI-1007, 51:9-11.

244. Notably, a POSITA looking into Bachl for implementation guidance of a UE that embodies the techniques of KwakPat883 would have reasons to stick to the similar techniques disclosed by KwakPat883 over those of Bachl for simultaneous transmission of SR and other uplink control signals, because as KwakPat883 identifies, by implementing the former, **“Performance deterioration does not occur when the ACK/NACK signal is detected after detecting the SR”** and **“The same scheduling request detection scheme** is used irrespective of a presence/absence of the ACK/NACK signal.” HUAWEI-1005, 8:15-16. *See* support from KwakProv812: **“One method** for detecting the SR signal has to be applied regardless of whether there is an ACK/NACK signal.” HUAWEI-1007, 52:9-10.

245. By contrast, Bachl “[uses] **“the higher order modulation scheme increases the size of the constellation of symbol values** so that information indicative of both the scheduling request and the acknowledgement or non-acknowledgment message can be transmitted using the resources allocated for transmission of the acknowledgement or non-acknowledgment message,” Bachl, [0032]. By using a higher order of modulation scheme, the bit error performance of the transmitted information (i.e., “both the scheduling request and the acknowledgement or non-acknowledgment message”) may deteriorate, especially when quality of the underlying wireless

channel is poor. *See e.g.*, R1-073011, a 3GPP publication proposed by the Patent Owner on the same subject matter, admits that “Increasing the order of modulation will decrease the link performance.” HUAWEI-1017, p.2.

246. Moreover, by using another modulation scheme, Bachl lacks the compatibility advantage that KwakPat883 possesses in that “[t]he same scheduling request detection scheme is used irrespective of a presence/absence of the ACK/NACK signal.” HUAWEI-1005, 8:15-16; HUAWEI-1007, 52:9-10.

247. Accordingly, in view of KwakProv812 (as incorporated by reference into KwakPat883) and Bachl, I believe a POSITA would have found it obvious to implement the UE of KwakProv812 (as incorporated by reference into KwakPat883) through use of at least one “processor,” “memory,” and “program storage medium” for its disclosed functions, and thus KwakPat883 in view of Bachl discloses each and every feature of claims 10, 11, 13-15, 17-24, and 46-48 as discussed in further detail below.

B. [10A] “A non-transitory computer readable medium encoded with a computer program executable by a processor to perform actions comprising”

248. KwakPat883 discloses a UE for performing the disclosed actions, e.g., “one UE may simultaneously transmit the SR and the ACK/NACK signal in the same subframe.” HUAWEI-1005, 12:21-23. KwakProv812 supports KwakPat883’s

disclosure by disclosing, for example, that “a certain UE is required to transmit the SR signal and the control signal.” HUAWEI-1007, 51:10-11.

249. Bachl discloses a non-transitory computer readable medium encoded with a computer program executable by a processor to perform actions of a UE: “the software implemented aspects of the invention are typically encoded on some form of **program storage medium** or implemented over some type of transmission medium,” and “[a] “mobile unit” (“such as ... **user equipment**”) includes “a processing unit” (i.e., processor) configured to perform the disclosed operations of the UE (“determine ...; and encode...”). See HUAWEI-1011, [0004], [0023], [0024], claim 22.

250. As discussed in this Section XIV-A above, a POSITA would have been led to combine KwakPat883 and Bachl and found it obvious that KwakPat883 in view of Bachl discloses the preamble of claim 10.

C. *[10B] “determining that an acknowledgment with acknowledgement data is to be sent on a physical uplink control channel,”*

251. See Section XI, [1B], *supra*.

D. *[10C] “where transmission of the acknowledgement on the physical uplink control channel comprises in addition to the acknowledgement data, a sequence that is unmodulated via a modulation scheme used for the acknowledgment data; and*

252. See Section XI, [1C], *supra*.

E. *[10D] “for a case where there is also a scheduling request to be sent, combine the acknowledgment with the scheduling request on a scheduling resource,*

253. See Section XI, [1D], *supra*.

F. [10E] *“else placing the acknowledgment in another resource.*

254. See Section XI, [1E], *supra*.

G. [11] *“The non-transitory computer readable medium encoded with a computer program of claim 10, comprising: for the case where there is also the scheduling request to be sent, transmitting the acknowledgment with the scheduling request on the scheduling resource.”*

255. See Section XI, [2], *supra*.

H. [13] *“The non-transitory computer readable medium encoded with a computer program of claim 10, where the another resource is a data-non-associated resource.”*

256. See Section XI, [4], *supra*.

I. [14A] *“An apparatus comprising”*

257. KwakPat883 expressly discloses hardware implementations of an apparatus (i.e., a UE) for performing the disclosed method:

The present invention can be implemented with **hardware**, software or combination thereof. In hardware implementation, the present invention can be implemented with one of an application specific integrated circuit (ASIC), a digital signal processor (DSP), a programmable logic device (PLD), a field programmable gate array (FPGA), a **processor**, a controller, a microprocessor, other electronic units, and combination thereof, which are **designed to perform the aforementioned functions**. In software implementation, the present invention can be implemented with a module for performing the aforementioned functions. **Software is storable in a memory unit and executed by the processor. Various means** widely known to those skilled in the art **can be used as the memory unit or the processor**.

HUAWEI-1005, 17:19-32.

258. See also KwakProv812 discloses an apparatus (i.e., a UE) for performing the disclosed method: “proposing an effective SR transmission method ... that a

certain UE is required to transmit the SR signal and the control signal.”

HUAWEI-1007, 51:10-11.

J. [14B] “at least one processor; and”

259. Bachl discloses “[a] “mobile unit” (“such as ... user equipment”) includes “**a processing unit**” (i.e., processor) configured to perform the disclosed operations of the UE (“determine ...; and encode...”). See HUAWEI-1011, claim 22.

260. As discussed in Section XIV-A above, I believe a POSITA would have been led to combine KwakPat883 with Bachl and found it obvious that the UE disclosed by KwakProv812 as incorporated by reference into KwakPat883 could have included at least one processor. Such an obvious implementation is further supported by KwakPat883’s express disclosure of at least one processor for hardware implementations of a UE:

The present invention can be implemented with **hardware**, software or combination thereof. In hardware implementation, the present invention can be implemented with one of an application specific integrated circuit (ASIC), a digital signal processor (DSP), a programmable logic device (PLD), a field programmable gate array (FPGA), a **processor**, a controller, a microprocessor, other electronic units, and combination thereof, which are **designed to perform the aforementioned functions**. In software implementation, the present invention can be implemented with a module for performing the aforementioned functions. **Software is storable in a memory unit and executed by the processor. Various means** widely known to those skilled in the art **can be used as the memory unit or the processor**.

HUAWEI-1005, 17:19-32.

K. [14C] “at least one memory including computer program code, where the at least one memory and the computer program code are

configured, with the at least one processor, to cause the apparatus to at least:”

261. Bachl discloses at least one memory (“memory”) including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor (“a processing unit”), to cause the apparatus (“user equipment”) to at least perform the recited operations:

terms such as **“processing” or “computing” or “calculating” or “determining” or “displaying” or the like** (“**refer to the action and processes of a computer system, or similar electronic computing device**, that manipulates and transforms data represented as physical, electronic quantities within **the computer system's registers and memories** into other data similarly represented as physical quantities within the **computer system memories or registers or other such information storage, transmission or display devices**.”

the software implemented aspects of the invention are typically encoded on some form of **program storage medium** or implemented over some type of transmission medium[.]

A mobile unit, comprising:
a processing unit configured to:
determine ...; and
encode...

See HUAWEI-1011, [0004], [0023], [0024], claim 22.

262. As discussed in Section XIV-A above, I believe a POSITA would have been led to combine KwakProv812 (as incorporated by reference into KwakPat883) with Bachl and found it obvious that KwakProv812 (as incorporated by reference into KwakPat883) in view of Bachl discloses the claim element [14C]. Such an obvious implementation is further supported by KwakPat883’s express disclosure that

an apparatus (e.g., UE) includes at least one memory including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to perform actions:

The present invention can be implemented with hardware, **software** or **combination** thereof....In **software implementation**, the present invention can be implemented with a module for performing the aforementioned functions. **Software is storable in a memory unit and executed by the processor. Various means** widely known to those skilled in the art **can be used as the memory unit or the processor.**

HUAWEI-1005, 17:19-32.

L. [14D] “determine that an acknowledgment is to be sent on a physical uplink control channel,”

263. See Section XI, [1B], *supra*.

M. [14E] “where transmission of the acknowledgement on the physical uplink control channel comprises in addition to the acknowledgement data, a sequence that is unmodulated via a modulation scheme used for the acknowledgment data; and”

264. See Section XI, [1C], *supra*.

N. [14F] “for a case where there is also a scheduling request to be sent, combine the acknowledgment with the scheduling request on a scheduling resource,”

265. See Section XI, [1D], *supra*.

O. [14G] “else placing the acknowledgment in another resource.”

266. See Section XI, [1E], *supra*.

P. [15] “The apparatus of claim 14, where the at least one memory including the computer program code is configured with the at least

one processor to cause the apparatus, for the case where there is also the scheduling request to be sent, to transmit the acknowledgment with the scheduling request on the scheduling resource.”

267. See Section XI, [2], *supra*.

Q. *[17A] The apparatus of claim 14, where the acknowledgment transmission is communicated on the scheduling resource if there is also a scheduling re-request combined with the acknowledgment transmission on the scheduling resource,*

268. See Section XI, [1D] and [2], *supra*.

R. *[17B] else the acknowledgment transmission is communicated on another resource.*

269. See Section XI, [1E], *supra*.

S. *[18] ““The apparatus of claim 14, where the another resource is a data-non-associated resource.”*

270. See Section XI, [4], *supra*.

T. *[19] “The apparatus of claim 15, where the acknowledgment with the scheduling request is transmitted on a physical uplink control channel.”*

271. See Section XI, [5], *supra*.

U. *[20] “The apparatus of claim 15, where the transmitter is configured to transmit the acknowledgment with the scheduling request on an uplink.”*

272. See Section XI, [6], *supra*.

V. *[21A] “The apparatus of claim 15, where the physical uplink control channel comprises an unmodulated sequence, and where the unmodulated sequence comprises reference signals and”*

273. See Section XI, [7A], *supra*.

W. [21B] *“the acknowledgement data comprises a BPSK/QPSK modulated sequence.”*

274. See Section XI, [7B], *supra*.

X. [22] *“The apparatus of claim 15, embodied in a user equipment.”*

275. KwakPat883 discloses a UE for performing the disclosed actions, e.g., “one UE may simultaneously transmit the SR and the ACK/NACK signal in the same subframe.” HUAWEI-1005, 12:21-23. KwakProv812 supports KwakPat883’s disclosure by disclosing, for example, that “a certain UE is required to transmit the SR signal and the control signal.” HUAWEI-1007, 51:10-11.

Y. [23] *“The apparatus of claim 15, configured to operate in a wireless communications network.”*

276. See Section XI, [8], *supra*.

Z. [24] *“The apparatus of claim 14 configured to operate in an evolved universal terrestrial radio access network.”*

277. See Section XI, [9], *supra*.

AA. [46A] *“An apparatus comprising:”*

278. See Section XIV, [14A], *supra*.

BB. [46B] *“at least one processor; and”*

279. See Section XIV, [14B], *supra*.

CC. [46C] *“at least one memory including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to at least:”*

280. See Section XIV, [14C], *supra*.

DD. *[46D] “determine that an acknowledgment transmission is to be sent”*

281. See Section XI, [43B] and Section XIV, [14D], *supra*.

EE. *[46E] “for a case where there is also a scheduling request to be sent, transmit the acknowledgment with the scheduling request on a scheduling resource in an uplink, where there is no need to specify a separate modulation or multiplexing operation used for transmission of the acknowledgement with the scheduling request, from a modulation or multiplexing operation used for transmission of the acknowledgement on another resource.”*

282. See Section XI, [43C] and [43D], *supra*.

FF. *[47] “The apparatus of claim 43, where the at least one memory including the computer program code is configured with the at least one processor to cause the apparatus to transmit the acknowledgment with the scheduling request on the scheduling resource.”*

283. See Section XI, [15], *supra*.

GG. *[48] “The apparatus of claim 43, where the transmitting is on a physical uplink control channel.”*

284. See Section XI, [1B] and [5], *supra*.

XV. Application of LGE and Bachl to the Challenged Claims of the ‘688 Patent

285. Claims 10-24, and 46-48 are computer-readable medium and apparatus claims that recite similar, if not identical language to the method claims 1-9, 37-40 and 42-45. As described in Section XII, LGE discloses an apparatus (e.g., UE) performing the recited operations of claims 1-9, 37-40, and 42-45, and hence the operations of claims 10-24, and 46-48. Although LGE does not expressly disclose so, I

believe a POSITA would have readily understood that a UE would have included at least one “processor,” “memory” or “non-transitory computer readable medium” to perform its disclosed functions because such implementations are well known and common practice in the art. For example, in an analogous prior art reference, Zhang, relating to transmitting feedback (including a channel quality indicator and an acknowledgement/negative acknowledgement) by a user equipment in a wireless communication system (HUAWEI-1019, Abstract), discloses that “The **UE 502 includes a processor 510,**” HUAWEI-1019, [0073] and methods performed by a UE are implemented with “memory” or “non-transitory computer readable medium”:

The **methods** or flow charts provided in the present invention **may be implemented** in a **computer program**, software, or firmware tangibly embodied in a **computer-readable storage medium** for execution by a general purpose computer or a processor. Examples of **computer-readable storage mediums include** a read only **memory** (ROM), a random access **memory** (RAM), a register, cache memory, semiconductor memory devices[.]
HUAWEI-1019, [0075].

286. Therefore, it would have been obvious to a POSITA that the UE disclosed by LGE would have included at least one “processor,” “memory” or “non-transitory computer readable medium” to perform its disclosed method and thus render obvious claims 10-24, and 46-48 because such implementations of a UE would have been well within the knowledge and capabilities of a POSITA.

287. However, to the extent that Patent Owner argues that a UE would not have included at least one “processor” and “memory” to perform its disclosed functions because LGE does not expressly disclose such a feature, Bachl is used as a supporting reference to show that, by the time of the earliest possible priority date of the ‘688 Patent, it had been well-known in the art that a UE would have included at least one “processor,” “memory” or “non-transitory computer readable medium” for its disclosed functions.

A. *Reasons to Combine LGE with Bachl*

288. Similar to LGE, Bachl also discloses “methods are provided for transmitting scheduling requests over uplink channels.” HUAWEI-1011, Abstract. Both LGE and Bachl relate to “wireless communication systems,” particularly, LTE systems. *See e.g.*, HUAWEI-1013, p.1 (for discussion and decision at 3GPP RAN 1 meeting for LTE); HUAWEI-1011, [0002], [0007] and [0008]. Both references solve the same problems of simultaneous transmission of SR and other uplink control signals including ACK/NACK. *See e.g.*, HUAWEI-1013, pp.1&5, HUAWEI-1011, [0011]-[0013]. I believe a POSITA seeking to implement a system based on LGE would have been led to Bachl to identify a specific configuration of a UE that would have the capabilities to implement the techniques of LGE. In doing so, they would also recognize that it is a known, common practice in the art that the disclosed

operations of the UE (e.g., for “transmitting scheduling requests over uplink channels,” (see HUAWEI-1011, Abstract; HUAWEI-1013, p.5)) could be software implemented by a computer system or electronic device (i.e., an apparatus) that includes a “processing unit,” “memory” and “program storage medium” as Bachl explains:

terms such as **“processing” or “computing” or “calculating” or “determining” or “displaying” or the like, refer to the action and processes of a computer system, or similar electronic computing device**, that manipulates and transforms data represented as physical, electronic quantities within **the computer system’s registers and memories** into other data similarly represented as physical quantities within the **computer system memories** or registers **or other such information storage**, transmission or display devices.

Note also that the **software implemented** aspects of the invention are typically encoded on some form of **program storage medium** or implemented over some type of transmission medium. The program storage medium may be magnetic (e.g., a floppy disk or a hard drive) or optical (e.g., a compact disk read only **memory**, or “CD ROM”), and may be read only or random access. Similarly, the transmission medium may be twisted wire pairs, coaxial cable, optical fiber, or some other suitable transmission medium known to the art. The invention is not limited by these aspects of any given implementation.

HUAWEI-1011, [0023], [0024].

289. Bachl further specifies that “[a] “mobile unit” (“such as ... user equipment”) includes “a processing unit” configured to perform the disclosed operations of the UE (“determine ...; and encode...”). See HUAWEI-1011, [0004], claim 22.

290. As such, in view of Bachl, a POSITA would have readily recognized that the UE disclosed by LGE could be implemented through use of at least one

“processing unit” (i.e., processor), “memory,” or “program storage medium” (i.e., non-transitory computer readable medium) for performing the disclosed operations that satisfy claims 10-23, and 43-45. Such a recognition would have directly followed from a POSITA’s common-sense knowledge because it is a well-known, routine practice in the art to use a device that has a “processing unit” and a “memory” when the device, like that disclosed in LGE, is required to execute techniques that require processing and storage of data. Moreover, it is a well-known and routine practice in the art to implement such techniques in software and, hence, via the “processing unit” executing a program accessed from a “program storage medium.” *See e.g.*, HUAWEI-1019, [0073], [0075]. Indeed, use of a “processor,” “memory” and a “program storage medium” in the UE of LGE would have been an implementation of a known technique or device for its ordinary purposes in the same way as has already been disclosed for similar devices (i.e., Bachl’s “mobile unit...such as ... user equipment”) versus LGE’s UE) to achieve a predictable result (e.g., transmitting scheduling requests over uplink channels, particularly, addressing the same problems of simultaneous transmission of SR and other uplink control signals including ACK/NACK). *See e.g.*, HUAWEI-1011, Abstract, [0011]-[0013]; HUAWEI-1013, p.5.

291. Notably, a POSITA looking into Bachl for implementation guidance of a UE that embodies the techniques of LGE would have reasons to stick to the similar

techniques disclosed by LGE over those of Bachl for simultaneous transmission of SR and other uplink control signals, because LGE advocates its “dedicated SR channel (i.e., ‘Alternative 2’)” over a scheme similar to Bachl’s in the cited reference [2], R1-073011, a 3GPP publication proposed by the Patent Owner on the same subject matter. HUAWEI-1017, p.1. R1-073011 proposes using “increased modulation order” for “[m]ultiplexing of Scheduling Request and ACK/NACK and/or CQI” but admits at least the disadvantage that “Increasing the order of modulation will decrease the link performance.” HUAWEI-1017, pp.1-2. By contrast, LGE’s “dedicated SR channel (i.e., ‘Alternative 2’)” is fully compatible and co-existing with the PUCCH in the same time-frequency resource,” thus achieving better compatibility and reducing signaling overhead or complexity for a recipient to be aware of a change of the modulation order. *See* HUAWEI-1013, p.5; HUAWEI-1017, p.1.

292. Accordingly, in view of LGE and Bachl, a POSITA would have found it obvious to implement the UE of LGE through use of at least one “processor,” “memory,” and “program storage medium” for its disclosed functions, and thus LGE in view of Bachl discloses each and every feature of claims 10-23 and 43-45 as discussed in further detail below.

B. [10A] “A non-transitory computer readable medium encoded with a computer program executable by a processor to perform actions comprising”

293. LGE discloses a UE for performing the disclosed actions, for example, “two separate channels will be **utilized by one UE** in order to transmit either one of SR or ACK/NACK signal” and “when **the UE** should transmit its SR and ACK/NACK signal simultaneously,” HUAWEI-1013, p.5.

294. Bachl discloses a non-transitory computer readable medium encoded with a computer program executable by a processor to perform actions of a UE: “the software implemented aspects of the invention are typically encoded on some form of **program storage medium** or implemented over some type of transmission medium,” and “[a] “mobile unit” (“such as ... **user equipment**”) includes “a processing unit” (i.e., processor) configured to perform the disclosed operations of the UE (“determine ...; and encode...”). See HUAWEI-1011, [0004], [0023], [0024], claim 22.

295. As discussed in this Section XV-A above, a POSITA would have been led to combine LGE and Bachl and found it obvious that LGE in view of Bachl discloses the preamble of claim 10.

C. [10B] “determining that an acknowledgment with acknowledgement data is to be sent on a physical uplink control channel,”

296. See Section XII, [1B], *supra*.

D. *[10C] “where transmission of the acknowledgement on the physical uplink control channel comprises in addition to the acknowledgment data, a sequence that is unmodulated via a modulation scheme used for the acknowledgment data; and*

297. *See Section XII, [1C], supra.*

E. *[10D] “for a case where there is also a scheduling request to be sent, combine the acknowledgment with the scheduling request on a scheduling resource,*

298. *See Section XII, [1D], supra.*

F. *[10E] “else placing the acknowledgment in another resource.*

299. *See Section XII, [1E], supra.*

G. *[11] “The non-transitory computer readable medium encoded with a computer program of claim 10, comprising: for the case where there is also the scheduling request to be sent, transmitting the acknowledgment with the scheduling request on the scheduling resource.”*

300. *See Section XII, [2], supra.*

H. *[12] “The non-transitory computer readable medium encoded with a computer program of claim 10, comprising: for a case where a channel quality indicator is also to be sent, the channel quality indicator is not sent and the another resource is unused.”*

301. *See Section XII, [3], supra.*

I. *[13] “The non-transitory computer readable medium encoded with a computer program of claim 10, where the another resource is a data-non-associated resource.”*

302. *See Section XII, [4], supra.*

J. [14A] “An apparatus comprising”

303. LGE discloses an apparatus (i.e., a UE) for performing the disclosed method: “two separate channels will be **utilized by one UE** in order to transmit either one of SR or ACK/NACK signal” and “when **the UE** should transmit its SR and ACK/NACK signal simultaneously,” HUAWEI-1013, p.5.

K. [14B] “at least one processor; and”

304. Bachl discloses “[a] “mobile unit” (“such as ... user equipment”) includes “**a processing unit**” (i.e., processor) configured to perform the disclosed operations of the UE (“determine ...; and encode...”). See HUAWEI-1011, claim 22.

305. As discussed in this Section XV-A above, I believe a POSITA would have been led to combine LGE with Bachl and found it obvious that the UE disclosed by LGE could have included at least one processor.

L. [14C] “at least one memory including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to at least:”

306. Bachl discloses at least one memory (“memory”) including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor (“a processing unit”), to cause the apparatus (“user equipment”) to at least perform the recited operations:

terms such as “**processing**” or “**computing**” or “**calculating**” or “**determining**” or “**displaying**” or the like) (“**refer to the action and processes of a computer system, or similar electronic compu-**

ting device, that manipulates and transforms data represented as physical, electronic quantities within **the computer system's registers and memories** into other data similarly represented as physical quantities within the **computer system memories or registers or other such information storage, transmission or display devices**.

the software implemented aspects of the invention are typically encoded on some form of **program storage medium** or implemented over some type of transmission medium[.]

A mobile unit, comprising:
a processing unit configured to:
determine ...; and
encode...

See HUAWEI-1011, [0004], [0023], [0024], claim 22.

307. As discussed in this Section XV-A above, a POSITA would have been led to combine LGE with Bachl and found it obvious that LGE in view of Bachl discloses the claim element [14C].

M. [14D] “determine that an acknowledgment is to be sent on a physical uplink control channel,”

308. See Section XII, [1B], *supra*.

N. [14E] “where transmission of the acknowledgement on the physical uplink control channel comprises in addition to the acknowledgement data, a sequence that is unmodulated via a modulation scheme used for the acknowledgment data; and”

309. See Section XII, [1C], *supra*.

O. [14F] “for a case where there is also a scheduling request to be sent, combine the acknowledgment with the scheduling request on a scheduling resource,”

310. See Section XII, [1D], *supra*.

P. *[14G] “else placing the acknowledgment in another resource.”*

311. See Section XII, [1E], *supra*.

Q. *[15] “The apparatus of claim 14, where the at least one memory including the computer program code is configured with the at least one processor to cause the apparatus, for the case where there is also the scheduling request to be sent, to transmit the acknowledgment with the scheduling request on the scheduling resource.”*

312. See Section XII, [2], *supra*.

R. *[16] “The apparatus of claim 14, where the at least one memory including the computer program code is configured with the at least one processor to cause the apparatus, for a case where a channel quality indicator is also to be sent, to drop the channel quality indicator such that it is not sent and the another resource is unused.*

313. See Section XII, [3], *supra*.

S. *[17A] The apparatus of claim 14, where the acknowledgment transmission is communicated on the scheduling resource if there is also a scheduling re-quest combined with the acknowledgment transmission on the scheduling resource,*

314. See Section XII, [1D] and [2], *supra*.

T. *[17B] else the acknowledgment transmission is communicated on another resource.*

315. See Section XII, [1E], *supra*.

U. *[18] “The apparatus of claim 14, where the another resource is a data-non-associated resource.”*

316. See Section XII, [4], *supra*.

V. *[19] “The apparatus of claim 15, where the acknowledgment with the scheduling request is transmitted on a physical uplink control channel.”*

317. See Section XII, [5], *supra*.

W. [20] *“The apparatus of claim 15, where the transmitter is configured to transmit the acknowledgment with the scheduling request on an uplink.”*

318. See Section XII, [7], *supra*.

X. [21A] *“The apparatus of claim 15, where the physical uplink control channel comprises an unmodulated sequence, and where the unmodulated sequence comprises reference signals and”*

319. See Section XII, [7A], *supra*.

Y. [21B] *“the acknowledgement data comprises a BPSK/QPSK modulated sequence.”*

320. See Section XII, [7B], *supra*.

Z. [22] *“The apparatus of claim 15, embodied in a user equipment.”*

321. LGE discloses a UE for performing the disclosed actions, e.g., “UEs [] transmit SR and ACK/NACK simultaneously in one subframe.” HUAWEI-1013, p.1.

AA. [23] *“The apparatus of claim 15, configured to operate in a wireless communications network.”*

322. See Section XII, [8], *supra*.

BB. [24] *“The apparatus of claim 14 configured to operate in an evolved universal terrestrial radio access network.”*

323. See Section XII, [9], *supra*.

CC. [46A] *“An apparatus comprising:”*

324. See Section XV, [14A], *supra*.

DD. [46B] *“at least one processor; and”*

325. See Section XV, [14B], *supra*.

EE. *[46C] “at least one memory including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to at least:”*

326. *See* Section XV, [14C], *supra*.

FF. *[46D] “determine that an acknowledgment transmission is to be sent”*

327. *See* Section XII, [43B] and Section XV, [14D], *supra*.

GG. *[46E] “for a case where there is also a scheduling request to be sent, transmit the acknowledgment with the scheduling request on a scheduling resource in an uplink, where there is no need to specify a separate modulation or multiplexing operation used for transmission of the acknowledgement with the scheduling request, from a modulation or multiplexing operation used for transmission of the acknowledgement on another resource.”*

328. *See* Section XII, [43C] and [43D], *supra*.

HH. *[47] “The apparatus of claim 46, where the at least one memory including the computer program code is configured with the at least one processor to cause the apparatus to transmit the acknowledgment with the scheduling request on the scheduling resource.”*

329. *See* Section XII, [15], *supra*.

II. *[48] “The apparatus of claim 46, where the transmitting is on a physical uplink control channel.”*

330. *See* Section XII, [1B] and [5], *supra*.

XVI. Application of KwakPat883, LGE and Bachl to the Challenged Claims of the ‘688 Patent

331. As described in Section XIV, I believe a POSITA would have been led to combine KwakPat883 and Bachl for implementation details of a UE for performing the disclosed operations of KwakPat883. The combined teachings of KwakPat883 and Bachl disclose each and every feature of independent claims 10 and 14, from which claims 12 and 16 depends, respectively.

332. As set forth in Section XIII, a POSITA would have been led to combine KwakPat883 and LGE for solutions of transmitting the SR for a case where a channel quality indicator is also to be sent. The combined teachings of KwakPat883 and LGE disclose the claim body of dependent claims 12 and 16.

333. The POSITA referring to Bachl when reviewing KwakPat883 would have been led to combine KwakPat883, LGE and Bachl for at least the same reasons set forth above in Section XIII for the combination of KwakPat883 and LGE when the POSITA reviewing KwakPat883 and LGE for solutions of transmitting the SR for a case where a channel quality indicator is also to be sent. A POSITA would have found it obvious and advantageous to combine KwakPat883 and LGE to achieve the envisioned scope and capabilities of KwakPat883 system to support simultaneous transmission of SR with another control signal, CQI, by applying LGE’s teaching of not sending the CQI and not using the another. *See* HUAWEI-1013, p.5 and FIG.4;

HUAWEI-1007, 52:19-20. A POSITA would have found it obvious that the combined teachings of KwakPat883 and LGE would be performed by a UE and could be implemented with a non-transitory computer readable medium and an apparatus with at least one memory including the computer program code, as well-known in the art and as expressly taught by KwakPat883 and Bachl. *See* Section XIV. As a result, the combined teachings of KwakPat883, LGE and Bachl satisfy each and every feature of claims 12 and 16 and thus render claims 12 and 16 obvious. *See* Section XIV, [10A]-[10E], [14A]-[14G] and Section XIII, [3], *supra*.


XVII. Conclusions

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

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further 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.

Executed this 12th day of June, 2017.

Respectfully submitted,

 2017.06.12
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Narayan Mandayam Ph.D.