

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners

v.

KT CORPORATION (Patent Owner) and
PEGASUS WIRELESS INNOVATION LLC (Exclusive Licensee)

Case No. IPR2025-00293

Patent 10,009,161

**DECLARATION OF SUMIT ROY IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 10,009,161**

Declaration of Sumit Roy in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,009,161

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1.	Claim 1 (Preamble): “A method for transmitting channel state information by a User Equipment (UE), the method comprising:”	24
a.	[1.1]: “receiving a reference signal for measuring channel quality from a base station;”	26
b.	[1.2]: “measuring the channel quality based on the reference signal, and selecting a channel quality indicator (CQI) index value from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on the measurement result of the channel quality; and”	29
c.	[1.3]: “transmitting channel state information including the selected CQI index value to the base station,”	32
d.	[1.4]: “wherein: the CQI index table includes three CQI index values for QPSK modulation, three CQI index values for 16QAM modulation, five CQI index values for 64QAM modulation, and four CQI index values for 256QAM modulation;”	34
e.	[1.5]: “one of the four CQI index values for 256QAM modulation is configured to have one code rate value that supports a same transmission efficiency as a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and”	36
f.	[1.6]: “another of the four CQI index values for 256QAM modulation is configured to have another code rate value same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and”	40
g.	[1.7]: “wherein: the one code rate value of the one of the four CQI index values for 256QAM modulation is calculated to be 711 using ‘code rate×1024,’”	44
h.	[1.8]: “the another code rate value of the another of the four CQI index values for 256QAM modulation is calculated to be 948 using ‘code rate×1024,’ and”	45

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- i. [1.9]: “a different another code rate value of a different another of the four CQI index values for 256QAM modulation is calculated to be 797 using ‘code rate×1024.’”.....47

2. Claim 2: “The method of claim 1, wherein the five CQI index values for 64QAM modulation, respectively, to have same difference within a predetermined error rate, as shown in a table below

CQI index	modulation	code rate × 1024	efficiency
0		out of range	
1	QPSK	78	0.1523
2	QPSK	193	0.3770
3	QPSK	449	0.8770
4	16QAM	378	1.4766
5	16QAM	490	1.9141
6	16QAM	616	2.4063
7	64QAM	466	2.7305
8	64QAM	567	3.3223
9	64QAM	666	3.9023
10	64QAM	772	4.5234
11	64QAM	873	5.1152.

” 61

3. Claim 3 (Preamble): “A method for receiving channel state information by a base station, the method comprising:” 63
- a. [3.1]: “creating a reference signal for measuring channel quality;”.....63
- b. [3.2]: “transmitting the reference signal to a User Equipment (UE); and” 63
- c. [3.3]: “receiving channel state information including a channel quality indicator (CQI) index selected from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on a measurement result of the channel quality, from the User Equipment,” 64
- d. [3.4]: “wherein: the CQI index table includes three CQI index values for QPSK modulation, three CQI index values for 16QAM modulation, five CQI index values for 64QAM modulation, and four CQI index values for 256QAM modulation;” 64

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- e. [3.5]: “one of the four CQI index values for 256QAM modulation is configured to have one code rate value that supports a same transmission efficiency as a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and” 64
- f. [3.6]: “another of the four CQI index values for 256QAM modulation is configured to have another code rate value same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and” 65
- g. [3.7]: “wherein: the one code rate value of the one of the four CQI index values for 256QAM modulation is calculated to be 711 using “code rate $\times$ 1024,” 65
- h. [3.8]: “the another code rate value of the another of the four CQI index values for 256QAM modulation is calculated to be 948 using “code rate $\times$ 1024,” and” 65
- i. [3.9]: “a different another code rate value of a different another of the four CQI index values for 256QAM modulation is calculated to be 797 using “code rate $\times$ 1024.” 65

4. Claim 4: “The method of claim 3, wherein the five CQI index values for 64QAM modulation, respectively, to have same difference within a predetermined error rate, as shown in a table below

CQI index	modulation	code rate $\times$ 1024	efficiency
0		out of range	
1	QPSK	78	0.1523
2	QPSK	193	0.3770
3	QPSK	449	0.8770
4	16QAM	378	1.4766
5	16QAM	490	1.9141
6	16QAM	616	2.4063
7	64QAM	466	2.7305
8	64QAM	567	3.3223
9	64QAM	666	3.9023
10	64QAM	772	4.5234
11	64QAM	873	5.1152.

- ” 66
5. Claim 5 (Preamble): “A User Equipment (UE) for transmitting channel state information, comprising:” 67

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- a. [5.1]: “a receiver configured to receive a reference signal for measuring channel quality from a base station;” 68
- b. [5.2]: “a controller configured to measure the channel quality based on the reference signal, and select a channel quality indicator (CQI) index value from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on the measurement result of the channel quality; and” 69
- c. [5.3]: “a transmitter configured to transmit channel state information including the selected CQI index value to the base station,” 71
- d. [5.4]: “wherein: the CQI index table includes three CQI index values for QPSK modulation, three CQI index values for 16QAM modulation, five CQI index values for 64QAM modulation, and four CQI index values for 256QAM modulation;” 71
- e. [5.5]: “one of the four CQI index values for 256QAM modulation is configured to have one code rate value that supports a same transmission efficiency as a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and” 72
- f. [5.6]: “another of the four CQI index values for 256QAM modulation is configured to have another code rate value same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and wherein:” 72
- g. [5.7]: “wherein: the one code rate value of the one of the four CQI index values for 256QAM modulation is calculated to be 711 using ‘code rate $\times$ 1024,’” 72
- h. [5.8]: “the another code rate value of the another of the four CQI index values for 256QAM modulation is calculated to be 948 using ‘code rate $\times$ 1024,’ and” 72
- i. [5.9]: “a different another code rate value of a different another of the four CQI index values for 256QAM modulation is calculated to be 797 using ‘code rate $\times$ 1024.’” 73

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6. Claim 6: “The User Equipment of claim 5, wherein and five CQI index values for 64QAM modulation, respectively, to have a same difference within a predetermined error rate, as shown in a table below

CQI index	modulation	code rate × 1024	efficiency
0		out of range	
1	QPSK	78	0.1523
2	QPSK	193	0.3770
3	QPSK	449	0.8770
4	16QAM	378	1.4766
5	16QAM	490	1.9141
6	16QAM	616	2.4063
7	64QAM	466	2.7305
8	64QAM	567	3.3223
9	64QAM	666	3.9023
10	64QAM	772	4.5234
11	64QAM	873	5.1152.

” 73

XIII. SECONDARY CONSIDERATIONS 74

XIV. CONCLUSION.....75

APPENDIX 1

Exhibit No.	Description
1001	U.S. Patent No. 10,009,161, issued on June 26, 2018 (“the ’161 Patent”)
1002	File History of U.S. Patent Application No. 15/454,020, filed on March 9, 2017(“the ’020 Application”)
1009	<i>Curriculum Vitae</i> of Sumit Roy
1012	PCT International Publication WO 2014/194681 to Xia et al. (“Xia”)
1013	3GPP TS 36.213 v10.4.0 (2011-12) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (Release 10)
1014	Chen, X. <i>et al.</i> , “A Novel CQI Calculation Scheme in LTE\LTE-A Systems”, 2011
1015	US Patent Application Publication No. 2013/0258877 to Ji et al. (“Ji”)
1016	Plaintiff and Counterclaim-Defendant Pegasus Wireless Innovation LLC’s Initial Proposed Constructions dated December 4, 2024, <i>Pegasus Wireless Innovation LLC v. Verizon Communications Inc., et al.</i> , Civ. Action No. 2:23-cv-00640 (E.D. Tex.)
1017	Defendants and Intervenor’s P.R. 4-2 Preliminary Claim Constructions and Extrinsic Evidence dated December 4, 2024, <i>Pegasus Wireless Innovation LLC v. Verizon Communications Inc., et al.</i> , Civ. Action No. 2:23-cv-00640 (E.D. Tex.)
1018	U.S. Patent Application Publication No. 2016/0211904 to Kim et al. (“Kim”)
1019	U. S. Patent Application Publication No. 2016/0249244 to Xia et al. (“Xia ’244”)

Exhibit No.	Description
1020	U.S. Patent Application Publication No. 2016/0219600 to Li et al. (“Li”)
1021	ZTE 3GPP TSG RAN WG1 Meeting W7S R1-135348 (“ZTE”)
1025	U.S. Patent Application Publication No. 2011/0216846 to Lee et al. (“Lee”)
1027	Certified English translation of PCT International Publication WO 2014/194681 to Xia et al.
1028	3GPP TSG RAN WG1 Meeting #77, R1-142638, WF on 256QAM CQI table design, Seoul, Korea 19 th -23 rd May 2014 (“R1-142638”)
1029	3GPP TSG RAN WG1 Meeting #76, R1-140034, Prague, Czech Republic, February 10-14, 2014 (“R1-140034”)
1030	3GPP TSG RAN WG1 Meeting #76bis, R1-141366, Shenzhen, China, 31 st March-4 th April, 2014 (“R1-141366”)

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I, Sumit Roy, hereby state as follows:

1. I have been retained by GOOGLE LLC, CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, T-MOBILE USA, INC., AT&T SERVICES, INC., NOKIA OF AMERICA, CORP., AND ERICSSON INC. (“Petitioners”) as an independent expert consultant in this *inter partes* review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Counsel for Petitioners (“Counsel”) to consider whether certain references teach or suggest the features recited in Claims 1-6 (“the Challenged Claims”) of U.S. Patent No. 10,009,161 (“the ’161 Patent”) (EX1001). My opinions and the bases for my opinions are set forth below.

3. I understand that the ’161 Patent is assigned to KT Corporation, which has given an exclusive license to Pegasus Wireless Innovation LLC.

4. I have been asked to provide an independent analysis of the ’161 Patent in view of the asserted prior art publications cited in the Petition. This Declaration is limited to those issues.

5. I am not, and never have been, an employee of KT Corporation, Pegasus Wireless Innovation LLC, or Petitioners. I am not receiving compensation for this Declaration beyond my normal hourly fees based on my time actually spent analyzing and documenting my opinions herein on the ’161 Patent, the asserted prior

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art publications cited in this Declaration and in the Petition, and the issues related thereto. My compensation is not related to the outcome of this proceeding, and I will not receive any additional compensation based on the outcome of any IPR or other proceeding involving the '161 Patent.

6. I am being compensated at my ordinary and customary consulting rate for my work, which is \$625 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

7. I have personal knowledge of the facts and opinions stated herein and, if called as a witness, could and would testify competently to them under oath.

I. BACKGROUND AND QUALIFICATIONS

8. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in the field of wireless networks.

9. I am an expert in the field of wireless networks (both commercial licensed cellular and unlicensed technologies) – having studied, taught, practiced, and researched this field for over thirty years. I summarize in this section my educational background, work experience, and other relevant qualifications. I

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understand that my curriculum vitae (CV) is being filed as EX1009 in this proceeding. I certify that EX1009 is a true and correct copy and sets forth the details of my educational history, work history, patents, and other related professional experience.

10. I earned my Bachelor of Technology degree in Electrical Engineering from Indian Institute of Technology in Kanpur, India in 1983. Subsequently, I earned my Master of Science and Doctor of Philosophy degrees in Electrical & Computer Engineering from University of California in Santa Barbara – with my dissertation being on “Estimation Strategies for a Network of Distributed Sensors.” I also simultaneously was awarded a Master of Arts in Statistics & Applied Probability from University of California in Santa Barbara in 1988.

11. While a graduate student (1983 through 1988), I worked on various projects related to wireless communication and radar systems using a mix of analytical modeling and computer simulation. This initial exposure to 3G cellular systems initiated a career pathway that traversed network evolution through 4G and current 5G systems, giving me a working knowledge of 3GPP technology standards governing these systems. In July 1988, I joined the faculty of the University of Pennsylvania as an Assistant Professor in the Department of Electrical Engineering, where I taught an upper level undergraduate course on “Communication Systems”

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and graduate level courses on “Advanced Digital Signal Processing” and “Digital Communications” and conducted research in my specialization.

12. In January 1995, I became a tenured Associate Professor in the Division of Engineering at the University of Texas at San Antonio, in San Antonio, Texas. In April 1998, I transferred to a tenured Associate Professor position in the Department of Electrical Engineering, University of Washington (“UW”) in Seattle, Washington and was promoted to Professor in September 2002. As a faculty member at UW, I have taught courses and directed research in networking and telecommunications, including 802.11 WLAN and cellular technologies. From September 2014 to September 2019, I was awarded Integrated Systems Term Professorship at UW in recognition of my leadership and national stature in this area.

13. I took full-time leave from UW to serve as a Senior Staff Researcher at Intel Labs, Hillsboro, OR from September 2001 to December 2003. In that role, I served as Wireless Systems Architect researching IEEE 802.15.3a Ultra-Wideband PHY layer for Wireless Personal Area Networks and pre-802.11n (MIMO WiFi). I also represented Intel at IEEE Standards meetings and coordinated with other industry partners. My research resulted in several patents relating to the above, including design implementation of MIMO WiFi transceivers. More recently (July 2020 – Aug. 2022), I served as Program Lead for the U.S. Department of Defense,

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Office of the Under Secretary of Defense's Innovate Beyond 5G program for research and experimentation within the 5G-to-xG (now renamed FutureG) initiative, where I had responsibility for monitoring commercial 5G evolution via 3GPP standardization.

14. As a result of my academic teaching, research, industry, and federal government experience, I have significant knowledge of wireless networking technologies. Since 1988, I have served as Principal Investigator for multiple competitively awarded research projects (in excess of \$10 M net funding) from various national organizations (both federal government and private industry sources) to support my research, as listed in my CV. I have authored and co-authored over 200 journal publications, conference proceedings, technical papers, book chapters, and technical presentations in a broad array of communications-related technologies, including networking and wireless communication. My work on Radar-WiFi Spectrum Sharing was recognized as the best paper published in IEEE Trans. Aerosp. Elect. Systems with annual Barry Carlton Award in 2016.

15. My professional affiliation with IEEE include serving in various professional societies as a reviewer for a number of technical publications, journals, and conferences. I have also received multiple awards and recognitions, most notably, elevation to IEEE Fellow in 2007 for "contributions to multi-user

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communications theory and cross-layer design of wireless networking standards.”

By IEEE bylaws, only 0.1% of IEEE membership is elevated to Fellow annually.

See <https://www.ieee.org/membership/fellows/steps.html>. In addition, I was selected as IEEE Communications Society’s Distinguished Lecturer (2014-15, 2017-18), which are listed in my curriculum vitae.

16. In addition to advising and mentoring students at UW, I have served as an external dissertation reviewer for several reputed international universities (e.g., McGill Univ., Montreal, CA; National University of Singapore, and Australia National University). During my career, I have advised and supervised over 35 Ph.D. students and numerous visiting scholars.

17. I have also served as an expert in certain legal proceedings. A list of cases in which I have testified at trial, hearing, or by deposition is provided in Appendix 1. Over the years, I have been retained by both patent owners as well as petitioners.

II. INFORMATION CONSIDERED

18. In preparation for this declaration, I have considered the materials discussed in this declaration, including, for example, the ’161 Patent, the references cited by the ’161 Patent, the prosecution histories of the ’161 Patent and applications from which it derives (including the references cited therein), various background

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articles and materials referenced in this declaration, and the prior art references identified in this declaration. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

III. RELEVANT LEGAL STANDARDS

19. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

20. I have been informed that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I have been informed that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

21. I have been informed that certain patent claim terms may be interpreted as “means-plus-function” claim terms. I have been informed that terminology is part

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of the U.S. Patent Law in 35 USC §112, paragraph 6 (pre-AIA) / 35 USC § 112(f) (post-AIA), which states the following: “An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.”

B. Perspective of One of Ordinary Skill in the Art

22. I have been informed that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I have been informed that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Anticipation

23. I have been informed that a claim is not patentable if it is anticipated. I have been informed that anticipation of a claim requires that every element of a claim is disclosed expressly or inherently in a prior art reference, arranged as in the claim, when considered from the perspective of a person of ordinary skill in the relevant art. I have been informed that when the structure recited in a reference is

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substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. I have been informed that extrinsic evidence may be used to explain but not expand the meaning of terms and phrases used in the reference relied upon as anticipatory of the claimed subject matter.

D. Obviousness

24. I have been informed that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

25. I have been informed that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long- felt but unmet need, failure of others, copying by others, and skepticism of experts).

26. I have been informed that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I have been informed that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I

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have been informed that a POSITA is presumed to know the relevant prior art. I have been informed that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

27. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I have been informed that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the Patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the Patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
- whether the combination is “obvious to try”;
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same

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field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;

- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

28. I have been informed that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I have been informed, however, that a teaching, suggestion, or motivation to combine is not required.

IV. SUMMARY OF OPINIONS

29. It is my opinion that Claims 1-6 of the '161 Patent are unpatentable under 35 U.S.C. §103 on the following grounds:

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Ground	Reference(s)	Basis	Claims
1	PCT International Publication WO 2014/194681 to Xia et al. (“Xia”) (EX1012) in view of 3GPP TS 36.213 v.10.4 (“3GPP 36.213”) (EX1013, EX1027) ¹	§103	1-6

V. TECHNOLOGY BACKGROUND

30. The ’161 Patent discloses methods and a UE for receiving a reference signal, measuring a channel quality based on the reference signal, and selecting a CQI index from a predetermined CQI index table that accounts for higher-order modulation (*e.g.*, 256QAM). EX1001, Abstract. The UE selects the CQI index based on the measurement result of the channel quality. *Id. See id.*, 2:15-38.

31. The ’161 Patent discloses that “a sharp increase in the number of user terminals and in the data usage.” EX1001, 1:54-55.

32. The ’161 Patent discloses that “a modulation method that can rapidly process a large amount of data traffic” is needed in order to address the increase in user terminals and data usage. *Id.*, 1:55-57. The modulation method disclosed is

¹ International Publication No. WO 2014/194681 is EX1012. The Certified English Translation of WO 2014/194681 is EX1027. Unless otherwise indicated, citations to Xia are to EX1027.

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256QAM, and the '161 Patent purports to “newly configur[e] a CQI index table in the case of adopting 256QAM as a newly defined modulation method.” *Id.*, 2:13-14. *See also id.*, 9:34-37, 19:5-22:25.

33. The '161 Patent purports to provide new table entries (e.g., rows) to an existing CQI index table so that the CQI index table supports 256QAM. EX1001, 19:5-22:25. *See also* EX1002, pp.134-136.

34. The '161 Patent's purported novelty is the inclusion of specific “code rate values”, including a code rate value of “797”, in the table entries for the 256QAM in the CQI table. *Id.*

35. However, such additions of 256QAM to existing CQI tables were not only known before the filing date of the '161 Patent, but the same methods and tables were used by other individuals (*e.g.*, participants in the 3GPP RAN1 working group) to improve and develop eventual 5G technologies by affording an option for 256QAM by adding entries in the CQI table. *See* EX1027.

36. Indeed, the prior art recognized varying code rates within a range from approximately equal intervals (*see, e.g.*, EX1027, 5:22-34, 39:42-40:10, 84:18-31, 127:8-20).

37. It was well known to optimize CQI tables, *e.g.*, to maximize throughput subject to an acceptable Block Error Rate. *See* EX1015, ¶¶[0003], [0094]; EX1014,

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pp.2-3. Patent Owner asserts no criticality associated with any specific intermediate code rate, and the prior art discloses ranges encompassing the claimed 797 code rate, rendering same *prima facie* obvious. See §XII.A.1.i.

38. The '161 Patent assigns no criticality to any particular code rate value, and 797 is merely one example of numerous proposed values. EX1001, 16:10-13 (“The code rate value obtained in such a manner *may be* configured to be 797 as CQI index 13.... That is, the code rate value ... *may be* configured to be 797.”) (emphasis added), 15:57 (For example...), 17:39-41, 3:54-65 (Figs. 18 and 21 illustrate “an example” of a CQI index table).

VI. THE CHALLENGED '161 Patent

39. The '161 Patent contains 6 claims. I have been asked to opine on the validity of Claims 1-6.

VII. THE '161 PATENT PROSECUTION HISTORY

40. I have reviewed the file history of the '161 Patent.

41. Patent Owner did not demonstrate or even assert criticality of the 797 code rate during examination. Rather, Patent Owner conceded that the 797 amendment was made “solely for the purpose of expediting prosecution”, not for the purpose of demonstrating criticality. EX1002, 134-135.

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42. The application which matured into the '161 Patent was only subjected to a single Office Action on the merits. EX1002, pp.140-148. (Office Action dated Nov. 29, 2017).

43. The Examiner made a first rejection to a first group of claims under §103 based on U.S. Patent Application Publication No. 2016/0211904 to Kim et al. ("Kim", EX1018) in view of U.S. Patent Application Publication No. 2016/0249244 to Xia et al. ("Xia '244", EX1019), in further view of U.S. Patent Application Publication No. 2016/0219600 to Li et al. ("Li", EX1020).

44. The Examiner made a second rejection to a second group of claims under §103 based on Kim in view of Xia '244, in view of Li, in further view of ZTE 3GPP TSG RAN WG1 Meeting W7S R1-135348 ("ZTE", EX1021).

45. In response, Applicant amended the claims to recite specific code rate values for 256QAM, including "711", "948", and "797". EX1002, pp.126-130. Applicant argued against the Office's asserted obviousness combination and various teachings of the references. *Id.*, pp.131-134.

46. Applicant also argued against the Office's application of Xia '244, Kim, and ZTE for the specific code rate values claimed in Applicant's amended claims. *See id.*, pp.134-136. Applicant asserted that:

the cited parts (i.e., Table 2, Table 3) of [*Xia '244*] merely disclose that 'code rate x 1024' for 256QAM may be '711.'

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The cited part (i.e., Table 32) of ***Kim*** merely discloses that ‘code rate x 1024’ **for 64QAM** (not ‘256QAM’) may be ‘948.’ See Index 15 in Table 32 of *Kim*. The cited part (i.e., table B. 1) of ***ZTE*** merely discloses that ‘code rate x 1024’ for 256QAM may be ‘803,’ ‘889,’ or ‘952.’ In summary, ***Kim*** does **not** disclose or teach the feature of claim 27 and ***ZTE*** also does **not** disclose or teach the feature (... 794 ...) [*sic*] of claim 28.

EX1002, p.135 (emphasis in original). Thus, Applicant relied on differences between the Challenged Claims and the prior art cited by the Office including (1) that Kim disclosed the “948” code rate for **64QAM**, not 256QAM; and (2) that ZTE did not disclose the “797” code rate, but only disclosed “803”, “889”, or “952”. *Id.*

47. Applicant also argued against the Office’s asserted obviousness combination of Xia ’244, Kim, and ZTE, for which the Office only offered that “[i]t would have been obvious to a person of ordinary skill in the art at the time the invention was made to change the 803 value into 797 value applied to one of the 256QAM modulation of Kim in view [Xia ’244] in view of Li without impacting any tangible difference over the spectrum efficiency.” *Id.*, p.147.

48. The Office subsequently allowed the application in view of Applicant’s amendment and arguments noting that the prior art “fails to teach or suggest the

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subject matter indicated by the Applicants with regard to the Amendment”. *Id.*, pp.108-113.

49. However, the art cited in this Petition and the expert testimony explains why the Challenged Claims are invalid.

VIII. LEVEL OF ORDINARY SKILL IN THE ART

50. A person of ordinary skill in the art (“POSITA”) pertinent to the ’161 Patent would have had a bachelor’s degree in electrical engineering, computer engineering, or a related discipline, knowledge of the relevant 3GPP standards as of this time, and at least 2 years of experience working in a field involving wireless communications.

51. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. *Id.*

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

IX. PRIORITY DATE

53. I have been informed that the “priority date” or “earliest effective filing date” of a patent is the date on which it is filed, or the date on which an earlier-filed U.S. or international patent application was filed if the patentee claims the benefit of

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priority to that earlier-filed U.S. or international patent application. For purposes of this declaration, I have assumed that the '161 Patent is entitled to a priority date of March 21, 2014, and I have not evaluated or formed an opinion on whether the claims of the '161 Patent are actually entitled to that date.

X. CLAIM CONSTRUCTION

54. For purposes of my analysis in this IPR proceeding, I have been informed that terms that appear in the claims of the '161 Patent should be interpreted according to their plain and ordinary meaning under the *Phillips* standard. In determining the ordinary and customary meaning, I have been informed that the words of a claim are first given their plain meaning that those words would have had to a POSITA at the time of the alleged invention. I also have been informed that the claims, specification, and file history may be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. I have been informed that even treatises and dictionaries may be used under limited circumstances to determine the meaning attributed by a POSITA to a claim term at the time of filing.

55. I also understand that, for terms that evoke a means plus function construction, “the construction of the claim must identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.” 37 C.F.R. §42.104(b)(3). I understand from counsel that

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construing a means-plus-function claim term is a two-step process that includes (1) identifying the claimed function and (2) then determining what structure, if any, disclosed in the specification corresponds to the claimed function.

56. I have reviewed the '161 Patent and its prosecution history as well as additional documents to construe the claims for performing my validity analysis. It is my understanding that some terms of the '161 Patent are in dispute in a related litigation. Below is a summary of claim constructions I have made for purposes of evaluating the Challenged Claims of the '161 Patent.

57. In Related Litigation, the parties proposed that certain claim terms should be given their plain and ordinary meaning. *See* EX1016, pp.14-15 (Plaintiff's initial proposed constructions); EX1017, pp.39-44 (Defendants' preliminary claim constructions). Plaintiff proposed that "wherein and five CQI index values for 64QAM modulation, respectively" in claim 6 be construed as "wherein the five CQI index values for 64QAM modulation, respectively." EX1016, p.15. The parties have adopted this construction. Defendants also proposed that the plain and ordinary meaning of "configured to" in claim 5 means "actually configured to and not merely capable of performing the claimed function". EX1017, p.42. Defendants have proposed that the term "to have [a] same difference within a predetermined

error rate” is indefinite. EX 1017, p.40. Defendants agreed to treat the preambles of claims 1, 3, and 5 as non-limiting.

58. For purposes of this Expert Declaration, I recognize that the term “to have [a] same difference within a predetermined error rate is found within the prior art, although the bounds of the term are unclear. Accordingly, the Grounds show where the this phrase may be found in the prior art. I apply the constructions proposed in the Related Litigation and agreed upon by the parties in the Grounds below. *See* EX1016, EX1017. While the proper metes and bounds of the claims are disputed in the Related Litigation, the cited prior art falls within these bounds whatever they may be.

59. The Challenged Claims are unpatentable under all potential constructions.

XI. OVERVIEW OF THE PRIOR ART REFERENCES

A. Xia (EX1012, EX1027)

60. Xia discloses methods and systems for transmitting channel state information and CQI indices from a UE to a base station. *See* EX1027, 3:12-22.

61. Xia discloses details of a UE determining a CQI index based on a measured channel quality and transmitting the CQI index to a base station. *Id. See also id.*, 3:32-73:28, Figs. 1-4. Xia discloses determining CQI indices for CQI tables including table entries for 256QAM. *See id.*, 75:7-93:13, Tables 5, 6-2 to 6-8. Xia

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discloses CQI tables including table entries for 256QAM including code rate values of at least “711”, “948”, and “790”. *Id.*, 89:3, Table 6-3.

62. Xia also discloses intervals of code rate values from which representative code rates can be selected.

63. Xia’s ranges include the 797 code rate value. *Id.*, 86:19-88:4, 89:3, Table 6-3.

B. 3GPP TS 36.213 (EX1013)

64. 3GPP 36.213 discloses 3GPP LTE standards including physical layer procedures such as CQI definitions, CQI tables, and operations performed by UEs and base stations in channel quality reporting. EX1013, §7.2.3.

65. 3GPP 36.213 provides details and specifications for implementing CQI reporting and explains the use of reference signals transmitted from base stations to UEs for measuring channel quality. *Id.* For example, 3GPP 36.213 provides “CQI indices and their interpretations” for up to 64QAM modulation in the CQI index table reproduced below.

Table 7.2.3-1: 4-bit CQI Table

CQI index	modulation	code rate x 1024	efficiency
0	out of range		
1	QPSK	78	0.1523
2	QPSK	120	0.2344
3	QPSK	193	0.3770
4	QPSK	308	0.6016
5	QPSK	449	0.8770
6	QPSK	602	1.1758
7	16QAM	378	1.4766
8	16QAM	490	1.9141
9	16QAM	616	2.4063
10	64QAM	466	2.7305
11	64QAM	567	3.3223
12	64QAM	666	3.9023
13	64QAM	772	4.5234
14	64QAM	873	5.1152
15	64QAM	948	5.5547

EX1013, p.65.

C. Chen (EX1014)

66. Chen discloses a CQI calculation method and signal-to-noise ratio (SNR) to CQI mapping scheme which is “extensively studied in previous works.”

EX1009, Abs.

67. Chen indicates that “calculation algorithms of CQI are numerous” and that “previous works utilize the SNR-CQI mapping to determine CQIs.” *Id.*, p.1, left col. “In this kind of CQI calculation algorithm, SNR is the only reference for CQI selection.” *Id.*

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68. Chen discloses that SNR-CQI mappings “are calculated in some fixed channel models (for examples, AWGN and Rayleigh channels)” and will result in CQI errors. *Id.*, right col.

69. Chen describes at least “three kinds of factors that will cause CQI errors.” *Id.*

70. Chen also describes the historic SNR-CQI mapping process and its limitations and Chen is clear that “SNR-CQI mapping in one channel model may fail to maintain a good performance in another.” EX1009, p.2, left col.

71. Chen notes that such a simplistic SNR-CQI mapping scheme “is incapable of achieving accurate CQI values.” *Id.*

72. Chen discloses that “[e]ach UE tries to find an optimal pair of modulation order and coding rate, which provides the largest throughput when the BLER is less than 10 percent.” *Id.*, pp 2-3.

73. The ’161 Patent uses the same process to determine SNR-CQI mapping and to subsequently determine CQI table entries for 256QAM. *See* EX1001, 8:5-43, Fig. 2.

D. Ji (EX1015)

74. Ji discloses that “CQI metrics may be used by the BS to determine code rates and modulation scheme” and “[t]he code rates and modulation scheme may be

selected not only to maximize the throughput to a particular UE, but also to improve the overall throughput of the base station communication area.” EX1015, ¶[0003].

75. Ji demonstrates that it was well known to optimize CQI based on receiver throughput. *Id.*, ¶[0094] (“the LTE specification is one way of reporting and using CQI for optimizing the receiver throughput, which sets a fixed BLER target for the UE that can simplify the optimization at the BS”).

XII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

A. Claims 1-6 Are Rendered Obvious over Xia and 3GPP TS 36.213 (Ground 1)

76. In my opinion, the Challenged Claims are unpatentable over the prior art.

77. The following sections reference where elements of Claims 1-6 are anticipated by the prior art.

1. Claim 1 (Preamble): “A method for transmitting channel state information by a User Equipment (UE), the method comprising:”

78. Xia discloses and suggests the Preamble of Claim 1.

79. Xia discloses “a method and device for indicating channel quality [via a CQI] and notifying a modulation and coding scheme.” EX1027, 3:9-10.

80. Xia discloses an “adaptive process of the Physical Downlink Shared Channel (PDSCH)” where a “User Equipment (UE) estimates the channel

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information used for measuring Channel State Information (CSI)” and “the UE calculates the Signal to Interference plus Noise Ratio (SINR)” by using the channel information. *Id.*, 3:12-17.

81. Upon estimating the channel information and measuring the CSI, the “UE then derives the corresponding Channel Quality Indicator (CQI) from the SINR and reports the CQI value to the base station”. *Id.*, 3:17-19. *See also id.*, 74:40-75:6. Xia’s UE (*see id.*) includes a “transmitter [] For sending the processor first CQI index to a base station.” *Id.*, 141:31.

82. Xia provides a method and apparatus for transmitting a CQI index by a UE. EX1027, 73:15-20, Fig. 1. Xia’s “terminal device” is a UE. *See id.*, Figs. 1-4, 74:40-75:6

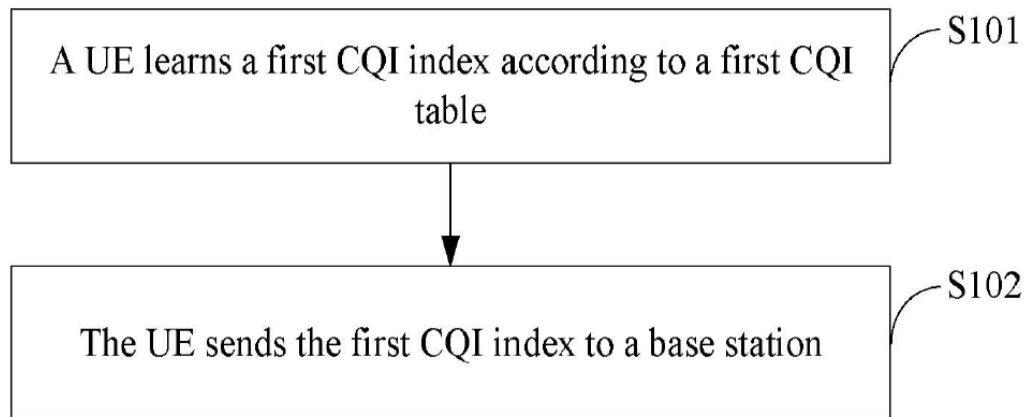


Fig. 1 of Xia

**a. [1.1]: “receiving a reference signal for measuring
channel quality from a base station;”**

83. Xia alone or in combination with 3GPP 36.213 discloses and suggests Element [1.1].

84. Xia discloses a method and apparatus for providing a notification, including a “channel quality indicator” (CQI), to a base station for selecting a modulation and coding scheme. EX1027, 3:8-10.

85. Xia discloses that a UE “estimates the channel information used for measuring Channel State Information (CSI)” for the purpose of measuring and indicating “channel quality” (e.g., CQI). *Id.*, 3:12-22, 74:40-75:6, 75:30-33.

86. A POSITA would have understood Xia’s disclosed use of “channel information used for measuring Channel State Information (CSI)” as teaching and suggesting the use of a reference signal received from the base station (BS).

87. Xia’s UE is in communication with the BS and seeks to measure and report “channel quality” in relation to the BS. EX1027, 3:8-22, 3:32-43, 74:40-75:6.

88. As such, it would have been obvious for the reference signal (upon which the CQI value is based) to originate from the BS to which the UE ultimately reports the CQI value. *Id.*

89. Transmission of a reference signal (RS) by a BS to a UE for channel measurement is a well-known technique used in CQI methods like Xia’s and does

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not impart patentability. EX1025, ¶[0166] (“a BS transmits a DL RS for channel measurement to a UE”). *See also id.*, ¶[0014].

90. It was well understood that channel quality reporting techniques like those disclosed by Xia are for the purpose of “improv[ing] communication between a base station (BS) and user equipment (UE)” and involve “received downlink (DL) signals ... in determining the channel quality indicator”. EX1015, ¶¶[0003]-[0004].

91. Further, Xia’s techniques build upon LTE systems (EX1027, 3:12-29, 96:32-39) which employ “Channel-State Information (CSI) *reference signals (CSI-RS)*,” as evidenced by 3GPP 36.213. *See* EX1013, p.63, §7.2.3 (emphasis added). The ’161 Patent discloses that the claimed “reference signal” is not limited and can be “CSI-RS,” corresponding to 3GPP 36.213’s disclosure. EX1001, 10:51-56, 15:4-8. Again, “CSI-RS” is not patentable.

92. If Xia is somehow found not to teach or suggest use of a reference signal received from a BS, it would have been obvious to modify Xia’s “channel information used for measuring Channel State Information” to employ the same (*e.g.*, “CSI-RS”) given the knowledge of a POSITA discussed above and the express teachings and suggestions of 3GPP 36.213.

93. As noted above, 3GPP 36.213 discloses that the CSI determination includes “reference signals” from which channel measurements are derived. *See*

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EX1013, p.63, §7.2.3 (“the UE shall derive the channel measurements for computing the CQI value reported in uplink subframe n based on only the Channel-State Information (CSI) reference signals (CSI-RS)”). 3GPP 36.213 sets forth standards for physical layer procedures (including CQI definitions) with LTE and thus is directly applicable to Xia.

94. Use of a reference signal from the BS in the manner taught by, *e.g.*, 3GPP 36.213 would have been a straightforward and predictable implementation of Xia’s techniques and a POSITA would have had a reasonable expectation of success.

95. A POSITA seeking to implement Xia would have been motivated to look to 3GPP standards (such as 3GPP 36.213) for details on CQI definitions and to verify the standard requirements for implementing CQI reporting in an LTE system such as Xia’s, ensuring the system follows 3GPP standards.

96. A POSITA would have looked to §7.2.3 for details on CQI definition and used the reference signals for measuring channel quality taught therein.

97. A POSITA would have had a reasonable expectation of success given that Xia and 3GPP 36.213 expressly teach and suggest use of a reference signal received from the BS in channel quality reporting techniques.

- b. [1.2]: “measuring the channel quality based on the reference signal, and selecting a channel quality indicator (CQI) index value from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on the measurement result of the channel quality; and”

98. Xia alone or in combination with 3GPP 36.213 discloses and suggests Element [1.2].

99. Xia’s terminal device/UE receives a reference signal as explained in Section XII.A.1.a. Xia’s terminal device/UE measures the channel quality based on the reference signal by “estimat[ing] the channel information used for measuring Channel State Information (CSI)” and then “calculat[ing] the Signal to Interference plus Noise Ratio (SINR)” by using the channel information. EX1027, 3:14-17, 3:12-22, 74:40-75:6.

100. As explained above, the “channel measurements for computing the CQI value” are “*based on* only the ... *CSI-RS*”, *i.e.*, the “channel state information reference signals” as disclosed by 3GPP 36.213. EX1013, p.63, §7.2.3.

101. For the reasons explained above in Section XII.A.1.a, Xia teaches and suggests use of the implementation details taught by 3GPP 36.213, and at a minimum, such implementation would have been obvious.

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102. 3GPP 36.213 is directly applicable to Xia and a POSITA would have been motivated by the disclosure of Xia describing measuring the channel quality to look to 3GPP standards (such as 3GPP 36.213) for details on the UE procedure for reporting Channel State Information (CSI) (EX1013, §7.2) to ensure a LTE system such as Xia's follows 3GPP standards and documentation. *See* §XII.A.1.a., *supra*.

103. Xia's UE "determines a first spectral efficiency based on the measured first SINR, and then acquires a first CQI index corresponding to the first spectral efficiency based on the first spectral efficiency and the first CQI table." EX1027, 75:30-32.

104. Xia's acquiring of the first CQI index based on the measured first SINR constitutes "measuring the channel quality based on the reference signal, and selecting a channel quality indicator (CQI) index value from a predetermined CQI index table . . . based on the measurement result of the channel quality" as claimed.

105. Xia's selection of the first CQI index corresponding to the first spectral efficiency is "based on" the measurement result of SINR from the reference signal because Xia explains that the first spectral efficiency is determined "based on the measured first SINR". *Id.*

106. Xia's CQI index tables include spectral efficiencies that are directly related to code rate. Similarly, the '161 Patent acknowledges that spectral efficiency

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is directly related to code rate. *See* EX1001, 8:17-18 (“a transmission efficiency (=modulation order x code rate value)”).

107. A POSITA would understand from Xia that a code rate value can be easily calculated based on a given spectral efficiency, and vice versa.

108. Xia discloses “selecting ... from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation”.

109. Xia discloses that the first CQI table is predetermined and includes CQI index values for 256 QAM. *See* EX1027, 75:7-29 (“first CQI table may be pre-defined by the protocol”); 75:34-35; 88:5-93:1, Tables 6-1 to 6-8.

110. For example, Table 6-3 of Xia provides a predetermined CQI index table including CQI index values for 256QAM modulation, from which a CQI index value is selected based on the measurement result of the channel quality:

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Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times 1024$ code rate $\times 1024$	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia

EX1027, Table 6-3.

c. [1.3]: “transmitting channel state information including the selected CQI index value to the base station,”

111. Xia alone or in combination with 3GPP 36.213 discloses and suggests Element [1.3].

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112. Xia discloses that the UE includes a “transmitter: For sending the processor first CQI index *to a base station*; to cause the said base station to determine a first Modulation and Coding Scheme (MCS) index from the first CQI index”. EX1027, 141:31-33 (emphasis added).

113. As evidenced by 3GPP 36.213, “time and frequency resources [] can be used by the UE to report CSI which consists of Channel Quality Indicator (CQI)”. EX1013, p.43, §7.2.

114. That is, the UE can “transmit periodic CSI reporting on PUCCH [*physical uplink control channel*]” (e.g., *to the base station*) and “transmit periodic CSI reporting on PUSCH [*physical uplink shared channel*]” (e.g., *to the base station*). *Id.*

115. For the reasons explained above in Section XII.A.1.a, Xia teaches and suggests use of the implementation details taught by 3GPP 36.213 and at a minimum, such implementation would have been obvious. 3GPP 36.213 is directly applicable to Xia and a POSITA would have been motivated by the disclosure of Xia describing for transmitting the first CQI index to look to 3GPP standards (such as 3GPP 36.213) for details on the UE procedure for reporting Channel State Information (CSI) (EX1013, §7.2) to ensure a LTE system such as Xia’s follows 3GPP standards and documentation. *See* §XII.A.1.a., *supra*.

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- d. [1.4]: “wherein: the CQI index table includes three CQI index values for QPSK modulation, three CQI index values for 16QAM modulation, five CQI index values for 64QAM modulation, and four CQI index values for 256QAM modulation;”**

116. Xia discloses and suggests Element [1.4].

117. Table 6-3 of Xia is a CQI index table that includes three CQI index values for QPSK modulation (CQI indexes 1, 2, and 3), three CQI index values for 16QAM modulation (CQI indexes 4, 5, and 6), five CQI index values for 64QAM modulation (CQI indexes 7, 8, 9, 10, and 11), and four CQI index values for 256QAM modulation (CQI indexes 12, 13, 14, and 15):

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Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times 1024$ code rate $\times 1024$	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia

118. Further, Xia discloses the following example satisfying Element [1.4]:

For example, assuming that the modulation method of *QPSK* in the first CQI table is *3 entries*, and the corresponding CQI index is 1-3; the modulation method of *16QAM* is *3 entries*, and the corresponding CQI index

is 4-6; the modulation method of **64QAM** is **5 entries**, and the corresponding CQI index is 7-11; and the CQI index range in the first CQI table is 0-15, the modulation method of the first CQI table is **4 entries**, and the corresponding CQI index is 12-15; the entries with the smallest CQI index is 12, and the specific is as shown in the table below. The entries with the CQI index of 12 in the first CQI table 1 corresponds to the CQI index 15 in the second CQI table 1. [Emphasis added.]

EX1027, 82:37-83:8.

119. Xia discloses that its CQI tables “contain entries with a modulation method higher than 64QAM”. *Id.*, 83:17-18.

120. Xia discloses that “the modulation method included in the first CQI table with a modulation method **higher than 64QAM** may be 128QAM and/or **256QAM**, etc.” *Id.*, 77:6-7 (emphasis added). *See also id.*, 85:7-93:13.

e. [1.5]: “one of the four CQI index values for **256QAM modulation is configured to have one code rate value that supports a same transmission efficiency as a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and**”

121. Xia discloses and suggests Element [1.5].

122. Xia teaches two types of CQI index tables: a first CQI table with a highest modulation of 256QAM, and a second, legacy CQI table with a highest

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modulation of 64QAM (i.e., “a CQI index table that excludes CQI index values for 256QAM modulation”). EX1027, 76:42. Xia’s second CQI table (e.g., Table 1) has a maximum transmission efficiency of 5.5547, associated with CQI index 15 and a code rate value of 948. Xia’s first CQI index table (e.g., Tables 6-1, 6-3, 6-5, 6-6, 6-7, and 6-8) includes four CQI index values for 256QAM, where the CQI index value of 12 has a code rate value (i.e., code rate value of 711) that supports a same transmission efficiency (i.e., 5.5547 spectral efficiency) of a CQI index table that excludes CQI index values for 256QAM (i.e., Xia’s second CQI table).

123. CQI index 15 of Xia’s second (64QAM) CQI table has the same spectral efficiency of 5.5547 as CQI index 12 of Xia’s first (256QAM) CQI table. *Compare* EX1027, Table 1 *with, e.g., id.*, Table 6-3.

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Table 1

CQI Index (CQI index)	Modulation method (modulation)	Code Rate $\times 1024$ (code rate $\times 1024$)	Spectral Efficiency (efficiency)
0	Out of Range		
1	QPSK	78	0.1523
2	QPSK	120	0.2344
3	QPSK	193	0.3770
4	QPSK	308	0.6016
5	QPSK	449	0.8770
6	QPSK	602	1.1758
7	16QAM	378	1.4766
8	16QAM	490	1.9141
9	16QAM	616	2.4063
10	64QAM	466	2.7305
11	64QAM	567	3.3223
12	64QAM	666	3.9023
13	64QAM	772	4.5234
14	64QAM	873	5.1152
15	64QAM	948	5.5547

Table 1 of Xia (Annotated) (i.e., a “Second” CQI Index Table)

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Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times 1024$ code rate $\times 1024$	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia (Annotated) (i.e., a “First” CQI Index Table)

124. As shown in Xia’s Tables 1 and 6-3, Xia discloses that “one of the four CQI index values for 256QAM modulation” (i.e., CQI index 12 in Table 6-3) “is configured to have one code rate value” (code rate=711) “that supports a same transmission efficiency” (i.e., 5.5547 in Table 6-3) “as a maximum transmission

efficiency” (i.e., 5.5547 in Table 1) “of a CQI index table that excludes CQI index values for 256QAM modulation” (i.e., legacy CQI Index Table 1 of Xia that does not include 256QAM entries), as claimed.

- f. [1.6]: “another of the four CQI index values for 256QAM modulation is configured to have another code rate value same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and”**

125. Xia discloses and suggests Element [1.6].

126. Xia’s legacy 64QAM Table 1 (i.e., “a CQI index table that excludes CQI index values for 256QAM modulation”) supports a maximum transmission efficiency of 5.5547 at CQI index 15. The associated code rate for this maximum spectral efficiency is 948, which is the same as the code rate for CQI index 15 in Xia’s first 256QAM CQI table, which has four CQI index rows for 256QAM modulation (e.g., Table 6-3). *Compare* EX1027, Table 1 *with id.*, Table 6-3.

127. Specifically, Xia’s first CQI index table includes four CQI index values for 256QAM, where the CQI index value of 15 in the first CQI table has a selected code rate value (i.e., code rate value of 948) that is the same as the code rate value (i.e., 948) having a maximum transmission efficiency (i.e., 5.5547 spectral efficiency) of a CQI index table that excludes CQI index values for 256QAM (Xia’s Table 1).

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128. As disclosed in Tables 6-1, 6-3, 6-5, 6-6, 6-7, and 6-8, the first CQI index table has a CQI index value of 15 including a selected code rate value (i.e., 948) that is the same as the code rate value for CQI index 15 in the legacy CQI table (Xia's second CQI table, Table 1) having a maximum spectral efficiency of 5.5547.

129. In Xia's second CQI table (i.e., a legacy table that excludes 256QAM, such as Table 1), there is a CQI index value of 15 having a maximum spectral efficiency of 5.5547 that corresponds to a code rate value of 948 at 64QAM.

130. The 948 code rate value is the same as the code rate value of 948 in the first CQI index table including the 256QAM modulation (e.g., Table 6-3).

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Table 1

CQI Index (CQI index)	Modulation method (modulation)	Code Rate $\times 1024$ (code rate $\times 1024$)	Spectral Efficiency (efficiency)
0	Out of Range		
1	QPSK	78	0.1523
2	QPSK	120	0.2344
3	QPSK	193	0.3770
4	QPSK	308	0.6016
5	QPSK	449	0.8770
6	QPSK	602	1.1758
7	16QAM	378	1.4766
8	16QAM	490	1.9141
9	16QAM	616	2.4063
10	64QAM	466	2.7305
11	64QAM	567	3.3223
12	64QAM	666	3.9023
13	64QAM	772	4.5234
14	64QAM	873	5.1152
15	64QAM	948	5.5547

Table 1 of Xia (Annotated) (i.e., a “Second” CQI Index Table)

CQI index 15 having code rate value (948)
having maximum transmission efficiency in
legacy table (i.e., excludes 256QAM)

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Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times 1024$ code rate $\times 1024$	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia (Annotated) (i.e., a “First” CQI Index Table)

Another CQI index value (e.g., index 15 for 256QAM) having code rate value (948) the same as the code rate value (948 in Table 1) with maximum efficiency in legacy table

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131. As shown in Xia's Table 1, the maximum transmission efficiency of Table 1 is 5.5547 at CQI index 15. The code rate for this maximum spectral efficiency is 948, which is the same as the code rate for CQI index 15 in Xia's first CQI table with the four 256QAM index rows (e.g., Table 6-3).

g. [1.7]: “wherein: the one code rate value of the one of the four CQI index values for 256QAM modulation is calculated to be 711 using ‘code rate×1024,’”

132. Xia discloses and suggests Element [1.7].

133. The recited “the one code rate value” refers to the “one code rate value” recited in Element [1.5] (*see* §XII.A.1.e.).

134. Xia's first CQI table (i.e., including 256QAM) includes a selected code rate value of one of the four CQI index values for 256QAM modulation as 711 using ‘code rate×1024’. EX1027, 88:5-89:3, Table 6-3.

135. Xia selects, from multiple groupings of spectral efficiencies from which code rate values can be calculated, 711 as the code rate value for the lower bounds of the four 256QAM CQI table entries. *See* EX1027, 86:19-88:5.

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Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times 1024$ code rate $\times 1024$	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia (Annotated)

h. [1.8]: “the another code rate value of the another of the four CQI index values for 256QAM modulation is calculated to be 948 using “code rate $\times$ 1024,” and”

136. Xia discloses and suggests Element [1.8].

137. The recited “the another code rate value” refers to the “another code rate value” recited in Element [1.6] (*see* §XII.A.1.f.).

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138. Xia's Table 6-3 (i.e., including 256QAM) includes a selected code rate value of the another of the four CQI index values for 256QAM modulation as 948 using 'code rate $\times$ 1024'. EX1027, 88:5-89:3, Table 6-3.

Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times$ 1024 code rate $\times$ 1024	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia (Annotated)

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139. Xia selects, from multiple groupings of spectral efficiencies from which code rate values can be calculated, 948 as the code rate value for the upper bounds of the four 256QAM CQI table entries. *See* EX1027, 86:19-88:5.

- i. **[1.9]: “a different another code rate value of a different another of the four CQI index values for 256QAM modulation is calculated to be 797 using ‘code rate×1024.’”**

140. Xia’s Table 6-3 is identical to the claimed CQI index table (both have four CQI index entries for 256QAM modulation with minimum and maximum code rate values of 711 and 948, respectively), except that Xia’s Table 6-3 includes a “different another code rate value” of 790 for CQI index 13, instead of the claimed 797. This difference does not impart patentability as explained below.

- (i) *Xia discloses selecting “approximately” constant intervals for 256QAM design and thus teaches and suggests the claimed 797 code rate given its admitted non-criticality*

141. The ’161 Patent does not require use of precisely constant SNR or spectral efficiency intervals between adjacent 256QAM CQI index values or entries. Nor does the ’161 Patent assign criticality to any specific code rate value—797 is merely one example. EX1001, 16:10-11 (“code rate value ... *may* be configured to be 797”).

142. Rather, the ’161 Patent teaches that upon selection of certain 256QAM parameters, *i.e.*, minimum and maximum code rate values (such as 711 and 948,

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respectively) and number of entries (four entries) across that range, the two remaining code rate values (between 711 and 948) for CQI indexes 13 and 14 may be selected such that differences of SNRs between adjacent CQI indexes are “almost the same”. EX1001, 14:3-8. *See also id.*, 16:4-12.

143. This flexibility of SNRs and associated code rates for the two intermediate CQI indexes is apparent from Figure 21 of the '161 Patent (256QAM, CQI indices 12-15), which does not employ exactly constant intervals between adjacent 256QAM entries.

144. The focus is on selecting the lowest code rate “to have the same transmission efficiency as the typical CQI index that has the highest transmission efficiency”, *i.e.*, 711 in Figure 21, but this was known. *Id.*, 14:43-53.

145. Xia teaches the same general approach to 256QAM design as the '161 Patent. *See* EX1027, 89:3, Table 6-3 (256QAM with four entries; CQI index 12=711; CQI index 15=948).

146. Xia's selected endpoints for the new 256QAM CQI entries span the ***exact same*** range of code rate values as claimed in the '161 Patent. *Id.* *See* EX1001, 14:39-53, Figure 21.

147. Further, like the '161 Patent, Xia does not require use of precisely constant intervals between 256QAM entries, but instead allows for “approximately”

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constant intervals. EX1027, 84:18-31 (CQI indexes are “an approximately arithmetic progression”; spectral efficiency is “within a range defined by a constant minus a present value and the same constant plus the preset value”), 86:6-18 (spectral efficiency is directly related to code rate). *See also id.*, 5:22-35, 39:42-40:11, 127:8-20.

148. Given that Xia teaches the same threshold 256QAM parameters—*i.e.*, the same number of entries (four) and the same minimum and maximum code rate values (711, 948)—all that would remain is the non-critical selection of any two intervening values between 711 and 948 that “approximate” constant intervals.

149. While Xia’s Table 6-3 happens to exemplify a CQI index 13 code rate value of 790, a POSITA would have recognized that selection of this particular exemplified value is not critical and it would have been obvious to employ other “approximate” values such as 797, as taught and suggested by Xia.

150. Further, the ’161 Patent assigns no criticality to any particular code rate value, and 797 is merely one example. EX1001, 16:10-13 (“The code rate value obtained in such a manner **may be** configured to be 797 as CQI index 13.... That is, the code rate value ... **may be** configured to be 797.”) (emphasis added), 15:57 (For example...), 17:39-41, 3:54-65 (Figs. 18 and 21 illustrate “an example” of a CQI index table).

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151. The '161 Patent does not explain how or why the 797 code rate was chosen for inclusion in its claimed CQI table. Nor did Patent Owner demonstrate or even assert criticality during examination. Rather, Patent Owner conceded that the 797 amendment was made “solely for the purpose of expediting prosecution”, not for the purpose of demonstrating criticality. EX1002, pp.134-135.

152. The '161 Patent does not purport that a code rate value of 797 is better than any other code rate values proposed for CQI index value 13. No single code rate value within each CQI value is critical and no single code rate value has any more or less advantage over others within a similar range (*e.g.*, 797 versus 790).

153. Further, as evidenced by 3GPP technical contributions and submissions such as EX1028 (“R1-142638”), 797 was a non-critical value for the CQI table.

154. 3GPP technical contributions relating to 256QAM CQI table design (see EX1029 (“R1-140034”), EX1030 (“R1-141366”)), which were publicly available before the earliest priority date of the '161 Patent, demonstrate that other viable options for the code rate value associated with CQI index value 13 were considered.

155. For example, Huawei, the same Applicant of PCT International Publication WO 2014/194681 to Xia (EX1012, EX1027), proposed a 790 code rate value and associated 256QAM CQI entries based on equal spectral efficiency gaps

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between adjacent CQI index values. *See* EX1028; *see also* EX1029 (“R1-140034”). While five RAN1 participants agreed with Huawei’s proposed approach to CQI table design, 10 other participants proposed CQI index tables based on “equal SINR interval [sic] with different [code rate] values” around the time of the purported invention. EX1028, p.3.

156. In 3GPP TSG RAN WG1 Meeting #77, where “the middle 256QAM entries” were proposed, a 790 code rate and associated 256QAM CQI entries were proposed by Huawei. *See* EX1028. *See also* EX1029 (“R1-140034”). Participants proposed 790 and 797 with no stated criticality of one code rate over the other. EX1028, pp.3-6.

157. 3GPP technical contributions for the 256QAM CQI entries (*see* EX1029 (“R1-140034”), EX1030 (“R1-141366”)), which were publicly available before the earliest priority date of the ’161 Patent, demonstrate that other viable options were considered. The publicly available technical contributions and proposals demonstrate that no considered code rate was critical. *See* EX1028.

158. As evidenced by R1-142638, the 797 code rate was selected not due to any criticality, but rather because it corresponded to the it was settled on as an “average value from the results with equal SINR interval between [[711], [948]]”. EX1028, p.4.

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159. A POSITA would have understood that selecting a code rate value as an average of values from various results of determined code rates would have been an obvious design choice given the breadth of acceptable code rate values for each CQI index.

160. The choice of 790 or 797 was merely a design choice, where either value would have been acceptable for the CQI table. *See* EX1028.

161. While the prior art and Xia relied upon herein based its code rate values on approximately constant intervals of spectral efficiency, EX1027, 40:1-5, publicly available 3GPP technical contributions and submissions demonstrate that both 790 and 797 were within an acceptable tolerance of code rate values considered for CQI index 13, and it would have been obvious to use approximately constant intervals of SNR or SINR.

162. For example, R1-142638 (EX1030), although not prior art, demonstrates that the selected code rate value of 797 had no criticality to the use and standardization of the CQI table. In fact, some participants agreed on the proposal for a code rate of 790 over 797. EX1028, p.3. This shows that not only was 797 non-critical, but that 790 was a viable alternative that would have produced similar results as 797.

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163. R1-141366 (EX1030) proposes a code rate value of 772, determined based on constant SINR intervals, and thus demonstrates there was a range of code rate values considered to be acceptable for CQI index 13 including values from at least 772 to 797. EX1030 (R1-141366). The 797 code rate was deemed within the range of acceptable code rate values. *Id.* A POSITA would have been motivated to use a constant SINR interval because both R1-140034 and R1-141366 teach that constant SINR spacing was a “design principle” of the CQI table. EX1029, pp.1-2; EX1030, p.1.

164. Although Xia used approximately constant intervals of spectral efficiency, the experimental results presented by Huawei (the same Applicant as Xia) in R1-140034 indicated that “[s]ince the curve of efficiency vs. SNR is almost linear, [] the new CQI entries for 256QAM could be samples based on approximately equal step size in spectral efficiency.” EX1029, p.2. *See also* EX1027, 75:30-32. Thus, Xia’s use of approximately constant spectral efficiency intervals is consistent with and suggests the use of approximately constant SINR intervals, and thus there is no criticality associated with selecting equal SINR intervals versus equal spectral efficiency intervals. Selecting a code rate of 797 would have been obvious given Xia’s and Huawei’s adherence to the “design principle” of approximately equal SINR intervals.

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165. Not only was there no criticality attached to 797, and no criticality associated with the use of approximately equal SINR or spectral efficiency intervals, the difference between the two values of 790 and 797 constitutes an acceptable tolerance of +/- 7 code rate values. *See, e.g., Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 783 (Fed. Cir. 1985). Additionally, 3GPP technical contributions (EX1030, R1-141366) dated March 21, 2014 demonstrate that values proposed for the first intermediate code rate in the range 711-948 (i.e., corresponding to CQI index 13) were proposed as low as “772.” Thus, as of the earliest claimed filing date of the ’161 Patent, an acceptable range of code rate values for CQI index 13 included at least values inclusive of 772-797 (i.e., a tolerance of +/-25), and Huawei’s and Xia’s 790 is squarely within this tolerance. A POSITA would have recognized that any value in this range would be viable.

166. As shown in R1-142638, 790 and 797 were two candidates for consideration for CQI index 13. In addition, 797 was not even originally considered, rather 797 was presented based on an “average value from the results with equal SINR interval between” the 711 and 948 end point code rates of the 256QAM entries. EX1028, p.4. R1-142638, although not prior art, demonstrates that the selected code rate value of 797 had no criticality to the use and standardization of the CQI table. Not only was 797 non-critical, but 790 was considered as a

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comparable alternative that would have produced similar results had 790 been included in the CQI table.

167. Indeed, while 10 RAN1 participants proposed various code rate values based on equal SINR intervals, five other participants advocated for a code rate value of 790 for CQI index 13 based on equal spectral efficiency intervals.

168. Thus, although 797 was ultimately selected for the standardized CQI table, R1-142638 shows that 790 was an equivalent alternative to 797 in view of the design principles enunciated. *See* EX1028, p.3.

169. Success of 5G and the updated CQI table including 256QAM did not depend on the 797 code rate value selected for CQI entry 13. No nexus exists between the code rate of 797, by itself, and any success of 5G.

170. Success of 5G was driven by overall improvements, including the use of 256QAM modulation as a whole, and not the specific code rates chosen for 256QAM.

171. Success of 5G would not have been altered by selection of the code rate value of 797. 5G would have been just as successful had 790 been used in the standardized CQI table.

172. 5G success was due to, for example, other improvements made to deliver data at faster speeds with lower latency and greater capacity, in part a

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function of 256QAM modulation, which was already in the public domain as evidenced by Xia. *See* EX1027.

173. As explained, Xia's Table 6-3 was a viable alternative to the standardized CQI table, and would have similarly contributed to the success of 5G, not due to specific code rates, but because of the inclusion of four 256QAM CQI entries ranging from code rates of 711 to 948, of which all delegates agreed upon. *See* EX1028.

174. Thus, Patent Owner cannot demonstrate criticality of the claimed 797 code rate value, and in view of the substantially identical approach to 256QAM CQI table design taught by Xia, use of such a code rate would have been obvious.

175. The claimed 797 code rate is *prima facie* obvious from the mere fact that it is very close to the 790 code rate value exemplified by Xia for CQI index 13.

176. As explained, the only difference between Xia and claim 1 of the '161 Patent is that Xia discloses a code rate of 790 for CQI index 13 in Table 6-3 instead of the 797 value as claimed. This difference cannot impart patentability, as the selection of code rate values for the CQI tables is taught and suggested by the prior art and a mere design choice.

177. A POSITA would have had a reasonable expectation of success in employing a 797 code rate value in Xia's 256QAM design at least given (i) the well-

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understood and predictable nature of code rates used in CQI notification methods, (ii) the art-recognized acceptance of “approximate” constant intervals between adjacent CQI index values, (iii) the art recognized “design principle” of equal SINR/efficiency intervals, and (iv) the disclosed use of the similar code rate of 790 disclosed by Xia (Table 6-3).

(ii) *A POSITA would have applied the art-recognized practice of selecting code rates to maximize throughput to the UE subject to an acceptable error rate in designing Xia’s 256QAM entries*

178. As explained above, Xia teaches the general conditions of the Challenged Claims, such as the general approach to 256QAM design and selection of 4 entries and 711 and 948 minimum and maximum code rates. Selection of the 797 code rate is not patentable.

179. Further, it was well-understood that code rates were selected to strike a balance of maximizing throughput to the UE subject to an acceptable error rate, and a POSITA would have applied this understanding to the design of 256QAM entries. *See, e.g.,* EX1015, ¶[0003] (“The code rates and modulation scheme may be selected not only to maximize the throughput to a particular UE, but also to improve the overall throughput of the base station communication area”), ¶[0094] (“the LTE specification is one way of reporting and using CQI for optimizing the receiver throughput, which sets a fixed BLER target for the UE that can simplify the

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optimization at the BS”); EX1014, pp.2-3 (“[e]ach UE tries to find an optimal pair of modulation order and coding rate, which provides the largest throughput when the BLER is less than 10 percent”).

180. This art-recognized relationship between code rate and throughput/error rate would have been considered during both the design of the CQI index table (*e.g.*, selecting/optimizing appropriate spectral efficiencies and corresponding code rates to populate the 256QAM entries) as well as during the use of such table (*e.g.*, selecting a particular CQI index value from the table). Applying such known optimization techniques to the known 256QAM modulation scheme is not patentable. The PTAB has consistently found claimed numerical limitations obvious where they involve no more than routine optimizations of predictable techniques, as is the case here.

181. A POSITA would have had a reasonable expectation of success in employing a 797 code rate given the well-understood and predictable nature of code rates used in CQI notification methods, and given the use of a similar code rate of 790 disclosed in Xia’s CQI Table. EX1027, 89:3, Table 6-3.

(iii) Xia discloses a range of between 711 and 948 which encompasses the two remaining code rates for CQI indexes 12 and 13 for 256QAM, rendering the 797 code rate prima facie obvious

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182. Xia discloses a minimum code rate value of 711 (CQI index 12) and a maximum code rate value of 948 (CQI index 15).

183. Given that Xia discloses four total entries for 256QAM, the two remaining (intervening) code rate values (only one of which is claimed) would necessarily fall within that range. That is, Xia teaches a range (between 711 and 948) which encompasses the claimed code rate, thus making such code rate value *prima facie* obvious.

184. Here, the claimed 797 value is both within the range between 711 and 948 and also very close to the 790 code rate exemplified by Xia for CQI index 13 in Table 6-3. Additionally, Xia discloses several code rate values for CQI index 13 ranging from 790 to 831, and the claimed 797 code rate also falls within the code rate value range of 790 to 831 for CQI index 13 suggested by Xia. The claimed 797 code rate is therefore *prima facie* obvious given that it is encompassed by the ranges disclosed and suggested by Xia.

185. For similar reasons, it would have been obvious to try other integer values within the ranges taught by Xia including code rate value 797. A POSITA would have recognized that in Table 6-3 of Xia, the code rate for CQI index 13 necessarily must fall within the range of CQI index 12 (code rate: 711) and CQI index 14 (code rate: 869).

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186. It would have been obvious to try other integer values within the range of 711 to 869 taught by Xia, given that such integers represent a finite number of identified, predictable solutions, particularly given that techniques for adjusting code rate value and determining the impact of said adjustments on the signal-to-noise ratio and spectral efficiency were well understood at the time of the '161 Patent.

187. The grounds in this Petition substantially differ from the issues considered during prosecution. The Examiner did not consider Xia's applicability as a primary reference. Nor did the Examiner consider the additional evidence (EX1013, EX1014, EX1015) presented in this Petition demonstrating the obviousness of the 797 code rate. In fact, nowhere in the prosecution history did the Examiner even consider the issue of whether it would have been obvious to adjust the 790 code rate in Xia, presented with a disclosure of a CQI table including all the other claimed code rates, such as the range of code rates for the 256QAM CQI entries 711-948.

188. In the Examiner's four-reference combination, only one code rate value was disclosed in each of the cited references, and the CQI tables did not all include 256QAM entries. This constitutes material error given that such adjustment to the code rate, in an otherwise fully disclosed table of 256QAM entries and code rates,

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would have been obvious for a number of reasons explained above. *See* §XII.B.2.,
infra.

2. **Claim 2: “The method of claim 1, wherein the five CQI index values for 64QAM modulation, respectively, to have same difference within a predetermined error rate, as shown in a table below**

CQI index	modulation	code rate × 1024	efficiency
0		out of range	
1	QPSK	78	0.1523
2	QPSK	193	0.3770
3	QPSK	449	0.8770
4	16QAM	378	1.4766
5	16QAM	490	1.9141
6	16QAM	616	2.4063
7	64QAM	466	2.7305
8	64QAM	567	3.3223
9	64QAM	666	3.9023
10	64QAM	772	4.5234
11	64QAM	873	5.1152.

”

189. Xia discloses the method of claim 1. *See* §XII.A.1.

190. Xia discloses wherein the five CQI index values for 64QAM modulation, respectively, to have same difference within a predetermined error rate, as shown in the table in claim 2.

191. Xia’s Table 6-3 discloses the exact same five CQI index entries for 64QAM modulation, respectively. EX1027, 89:3, Table 6-3.

192. Table 6-3 discloses all of the same values (including code rate, spectral efficiency, modulation scheme, and CQI index) as the claimed table of claim 2.

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Table 6-3

CQI index in the first CQI table	CQI index in the second CQI table	Modulation method modulation	Code Rate $\times 1024$ code rate $\times 1024$	Spectral efficiency efficiency
0	0	out of range		
1	1	QPSK	78	0.1523
2	3	QPSK	193	0.3770
3	5	QPSK	449	0.8770
4	7	16QAM	378	1.4766
5	8	16QAM	490	1.9141
6	9	16QAM	616	2.4063
7	10	64QAM	466	2.7305
8	11	64QAM	567	3.3223
9	12	64QAM	666	3.9023
10	13	64QAM	772	4.5234
11	14	64QAM	873	5.1152
12	15	256QAM	711	5.5547
13	-	256QAM	790	6.1719
14	-	256QAM	869	6.7891
15	-	256QAM	948	7.4063

Table 6-3 of Xia (Annotated)

193. In Related Litigation, Defendants have proposed that the term “to have same difference within a predetermined error rate” is indefinite. EX1017, p.40.

194. Claim 2 further specifies that this relationship is “as shown in” the table recited in claim 2.

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195. Since Xia discloses the exact contents of the table, and in the same order for 64QAM entries, as explained above, Xia also satisfies the claimed relationship “same difference within a predetermined error rate”. Thus, Xia discloses claim 2.

3. Claim 3 (Preamble): “A method for receiving channel state information by a base station, the method comprising:”

196. Xia discloses and suggests the Preamble of claim 3. *See* §XII.A.1., *supra*. Xia discloses that the CSI, including a CQI index, is received by a base station. EX1027, 93:14-20, 141:27-33. *See also id.*, Figs. 2, 3. *See* §§XII.A.1., XII.A.1.b., *supra*.

a. [3.1]: “creating a reference signal for measuring channel quality;”

197. Xia alone or in combination with 3GPP 36.213 discloses and suggests Element [3.1]. *See* §XII.A.1.a., *supra*.

b. [3.2]: “transmitting the reference signal to a User Equipment (UE); and”

198. Xia alone or in combination with 3GPP 36.213 discloses and suggests Element [3.2]. *See* §XII.A.1.b., *supra*.

- c. **[3.3]: “receiving channel state information including a channel quality indicator (CQI) index selected from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on a measurement result of the channel quality, from the User Equipment,”**

199. Xia alone or in combination with 3GPP 36.213 discloses and suggests Element [3.3]. *See* §XII.A.1.c., *supra*.

200. Xia’s base station receives the CQI index. EX1027, 93:14-20, 141:27-33, Figs. 2, 3.

- d. **[3.4]: “wherein: the CQI index table includes three CQI index values for QPSK modulation, three CQI index values for 16QAM modulation, five CQI index values for 64QAM modulation, and four CQI index values for 256QAM modulation;”**

201. Xia discloses and suggests Element [3.4]. *See* §XII.A.1.d., *supra*.

- e. **[3.5]: “one of the four CQI index values for 256QAM modulation is configured to have one code rate value that supports a same transmission efficiency as a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and”**

202. Xia discloses and suggests Element [3.5]. *See* §XII.A.1.e., *supra*.

- f. [3.6]: “another of the four CQI index values for 256QAM modulation is configured to have another code rate value same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and”**

203. Xia discloses and suggests Element [3.6]. *See* §XII.A.1.f., *supra*.

- g. [3.7]: “wherein: the one code rate value of the one of the four CQI index values for 256QAM modulation is calculated to be 711 using “code rate×1024,”**

204. Xia discloses and suggests Element [3.7]. *See* §§XII.A.1.g., XII.A.1.e.,
supra.

- h. [3.8]: “the another code rate value of the another of the four CQI index values for 256QAM modulation is calculated to be 948 using “code rate×1024,” and”**

205. Xia discloses and suggests Element [3.8]. *See* §§XII.A.1.f., XII.A.1.h.,
supra.

- i. [3.9]: “a different another code rate value of a different another of the four CQI index values for 256QAM modulation is calculated to be 797 using ‘code rate×1024.’”**

206. Xia teaches and suggests Element [3.9]. *See* §XII.A.1.i., *supra*.

4. **Claim 4: “The method of claim 3, wherein the five CQI index values for 64QAM modulation, respectively, to have same difference within a predetermined error rate, as shown in a table below**

CQI index	modulation	code rate × 1024	efficiency
0		out of range	
1	QPSK	78	0.1523
2	QPSK	193	0.3770
3	QPSK	449	0.8770
4	16QAM	378	1.4766
5	16QAM	490	1.9141
6	16QAM	616	2.4063
7	64QAM	466	2.7305
8	64QAM	567	3.3223
9	64QAM	666	3.9023
10	64QAM	772	4.5234
11	64QAM	873	5.1152.

207. Xia discloses the method of claim 3. *See* §XII.A.3., *supra*.

208. Xia discloses and suggests the method of claim 4 for at least the reasons discussed above with respect to claim 2.

209. In Related Litigation, Defendants have proposed that the term “to have same difference within a predetermined error rate” is indefinite. EX1017, p.40.

210. Claim 4 further specifies that this relationship is “as shown in” the table recited in claim 4.

211. Since Xia discloses the exact contents of the table, and in the same order for 64QAM entries, as explained above, Xia also satisfies the claimed relationship “same difference within a predetermined error rate”. Thus, Xia discloses claim 4.

5. Claim 5 (Preamble): “A User Equipment (UE) for transmitting channel state information, comprising:”

212. Xia discloses the Preamble of Claim 5. *See* §XII.A.1., *supra*.

213. Xia’s “terminal”/“user equipment” is a UE that performs the method for transmitting channel state information claimed in claim 1. *See id.*; *see* EX1027, Figs. 1-4, 74:40-75:6.

214. Xia uses various terms when referring to the UE used to transmit CSI to the base station including “terminal (UE)” (EX1027, 7:8-9), “CQI notification device” (*id.*, 125:14-15, 141:27-142:43), “device for notifying CQI” (*id.*, 38:2-3, 72:3-4), and “User Equipment (UE)” (*id.*, 75:1-2). *See also id.*, Abs. (“The terminal obtains the first CQI index based on the first CQI table”); 75:16-29, 141:27-33 (a “CQI notification device 90, which comprises: a processor 91 . . . for acquiring a first CQI table; and for acquiring a first CQI index from the first CQI table”), 142:44-143:5 (a base station “receive[s] the first Channel Quality Indicator (CQI) Number *sent by the terminal (UE)*, and the said first CQI index is determined by the said UE based on the acquired first CQI table”) (emphasis added). The UE/CQI notification device perform the same CQI notification methods described in Xia. *Id.*, 75:13-18, 142:41-43.

a. [5.1]: “a receiver configured to receive a reference signal for measuring channel quality from a base station;”

215. Xia alone or in combination with 3GPP 36.213 discloses and suggests a receiver configured to receive a reference signal for measuring channel quality from a base station. *See* §XII.A.1.a., *supra*.

216. Xia’s UE includes at least a receiver configured to receive signals. *See* EX1027, 123:27-125:13, Fig. 5.

217. To the extent Xia does not disclose a UE expressly including a receiver configured to receive a reference signal, 3GPP 36.213 discloses a UE “configured by higher layers” where “the UE shall derive the channel measurements for computing the CQI value reported in uplink subframe n based on only the Channel-State Information (CSI) reference signals defined in [3] for which the UE is configured to assume non-zero power.” EX1013, p.63, §7.2.3.

218. A POSITA would have been motivated to turn to 3GPP 36.213 to ensure Xia’s LTE CQI notifying system complied with the 3GPP standards.

219. A POSITA would thus have recognized that a UE must include a receiver configured to receive reference signals transmitted by a base station, specifically reference signals such that the UE could measure channel quality so that a CQI index could ultimately be determined, as described in Xia.

220. A POSITA would have had a reasonable expectation of success given 3GPP 36.213 discloses UEs configured for various functions, including receiving reference signals for CQI reporting.

b. [5.2]: “a controller configured to measure the channel quality based on the reference signal, and select a channel quality indicator (CQI) index value from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on the measurement result of the channel quality; and”

221. Xia alone or in combination with 3GPP 36.213 discloses and suggests a UE including a controller configured to measure the channel quality based on the reference signal, and select a channel quality indicator (CQI) index value from a predetermined CQI index table including CQI index values for 256 quadrature amplitude modulation (QAM) modulation, based on the measurement result of the channel quality. *See* §§XII.A.1.b., XII.A.5., *supra*.

222. As explained in §XII.A.5., Xia’s CQI notification device constitutes a UE. Xia discloses a CQI notification device 90 in Figure 9 including a processor 91.

223. The processor 91 of the CQI notification device is configured “for acquiring a first CQI table; and for acquiring a first CQI index from the first CQI table”. EX1027, 141:27-33.

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224. Xia's CQI notifying apparatus learning a first CQI index constitutes selecting a CQI index from the first CQI table.

225. Xia's first CQI tables includes Table 6-3 including the 256QAM CQI index values. Processor 91 of the CQI notifying apparatus constitutes a controller.

226. To the extent Xia does not disclose a UE expressly including a controller configured to measure the channel quality ***based on*** the reference signal, 3GPP 36.213 discloses a UE "configured by higher layers" where "the UE shall derive the channel measurements for computing the CQI value reported in uplink subframe n based on only the Channel-State Information (CSI) reference signals". EX1013, p.63, §7.2.3.

227. A POSITA would have been motivated to turn to 3GPP 36.213 to ensure Xia's LTE CQI notifying system and apparatus complied with the 3GPP standards.

228. A POSITA would thus have recognized that a UE must include a controller/processor configured to measure the reference signal transmitted by a base station and select a CQI index based on the measurements of the reference signal.

229. A POSITA would have had a reasonable expectation of success given 3GPP 36.213 discloses UEs configured for various functions, including receiving

and measuring reference signals, and selecting CQI indices from a table for CQI reporting.

c. [5.3]: “a transmitter configured to transmit channel state information including the selected CQI index value to the base station,”

230. Xia discloses and suggests a UE including transmitter configured to transmit channel state information including the selected CQI index value to the base station. *See* §§XII.A.1.c., XII.A.5., *supra*.

231. Xia discloses the CQI notifying apparatus 90 in Figure 9 including a transmitter 92. The transmitter is configured “[f]or sending the processor first CQI index to a base station”. EX1027, 141:27-33.

d. [5.4]: “wherein: the CQI index table includes three CQI index values for QPSK modulation, three CQI index values for 16QAM modulation, five CQI index values for 64QAM modulation, and four CQI index values for 256QAM modulation;”

232. Xia discloses and suggests Element [5.4]. *See* §§XII.A.1.d., XII.A.5.b., *supra*.

- e. **[5.5]: “one of the four CQI index values for 256QAM modulation is configured to have one code rate value that supports a same transmission efficiency as a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and”**

233. Xia discloses and suggests Element [5.5]. *See* §§XII.A.1.e., XII.A.5.b.,
supra

- f. **[5.6]: “another of the four CQI index values for 256QAM modulation is configured to have another code rate value same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation; and wherein:”**

234. Xia discloses and suggests Element [5.6]. *See* §§XII.A.1.f., XII.A.5.b.,
supra.

- g. **[5.7]: “wherein: the one code rate value of the one of the four CQI index values for 256QAM modulation is calculated to be 711 using ‘code rate×1024,’”**

235. Xia discloses and suggests Element [5.7]. *See* §§XII.A.1.g., XII.A.5.b.,
supra.

- h. **[5.8]: “the another code rate value of the another of the four CQI index values for 256QAM modulation is calculated to be 948 using ‘code rate×1024,’ and”**

236. Xia discloses and suggests Element[5.8]. *See* §§XII.A.1.h., XII.A.5.b.,
supra.

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- i. [5.9]: “a different another code rate value of a different another of the four CQI index values for 256QAM modulation is calculated to be 797 using ‘code rate×1024.’”

237. Xia teaches and suggests Element [5.9]. See §§XII.A.1.i., XII.A.5.b., *supra*.

6. **Claim 6: “The User Equipment of claim 5, wherein and five CQI index values for 64QAM modulation, respectively, to have a same difference within a predetermined error rate, as shown in a table below**

CQI index	modulation	code rate × 1024	efficiency
0		out of range	
1	QPSK	78	0.1523
2	QPSK	193	0.3770
3	QPSK	449	0.8770
4	16QAM	378	1.4766
5	16QAM	490	1.9141
6	16QAM	616	2.4063
7	64QAM	466	2.7305
8	64QAM	567	3.3223
9	64QAM	666	3.9023
10	64QAM	772	4.5234
11	64QAM	873	5.1152.

238. Xia discloses and suggests claim 5. See §XII.A.5., *supra*. See also §X.

239. Xia discloses and suggests the method of claim 6 for at least the reasons discussed above with respect to claim 2.

240. Claim 6 specifies that the relationship “to have a same difference within a predetermined error rate” is “as shown in” the table recited in claim 6. Since Xia discloses the contents of the table, and in the same order for 64QAM entries, as

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explained, Xia also satisfies the claimed relationship “to have a same difference within a predetermined error rate.”

XIII. SECONDARY CONSIDERATIONS

241. As discussed herein, all elements of the Challenged Claims were known in the art, and any differences would have been obvious to a POSITA based on the disclosures of the applied references and the knowledge in the art.

242. I am not aware of any secondary considerations that would alter my opinion. For instance, there was no long felt need as multiple different databases and calibration data used for determining locations of wireless device were known and used before the effective filing date of the '161 Patent.

243. As another example, the '161 Patent and its techniques are not widely used in the art or incorporated into any commercially successful location determination systems. I am not aware of a location determination system that is commercially successful marked with the '161 Patent.

244. Any secondary considerations evidence Owner may offer in this proceeding would be insufficient to overcome the strong evidence that the Challenged Claims are obvious.

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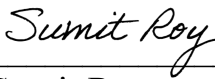
XIV. CONCLUSION

245. For the reasons set forth above, it is my opinion that all elements of the Challenged Claims of the '161 Patent are disclosed or suggested by the prior art. In my opinion, the Challenged Claims of the '161 Patent would have been obvious over the prior art.

246. In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in 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.

247. 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.

Date: 12-29-2024



Sumit Roy

APPENDIX 1

SUMIT ROY, Ph.D.

RESUME ADDENDUM

LITIGATION RELATED EXPERIENCE

Dr. Roy has served as an expert witness on the matters disclosed below (underlined denotes party represented).

Case:	<u>Marvell Semiconductor</u> et al. vs. Commonwealth Scientific and Industrial Research Organization
Jurisdiction:	United States District Court Eastern District of Texas Civil Action No. 6:2007-CV-00204
Nature of Case/Notes:	Patent infringement US Patent 5487069
Work Product:	On Behalf of plaintiff Marvell Semiconductor. Wrote expert Report on Non-Infringement, deposed before opposing attorney.
Counsel:	Retained by White & Case LLP (lead: Warren Heit wheat@paloalto.whitecase.com)
Date:	2009. <u>Status -closed.</u>
Case:	<u>X10</u> vs. Guardian Technologies
Jurisdiction:	United States District Court Northern District of Texas Civil Action No. 3:2009-CV-00649
Nature of Case/Notes:	Patent infringement US Patent 5657076
Work Product:	Wrote expert report on behalf of X10
Counsel:	Retained by Black Lowe & Graham (lead: Larry Graham; graham@blacklaw.com)
Date:	2010. <u>Status - closed.</u>
Case:	Commonwealth Scientific and Industrial Research Organization vs. <u>Sony Corporation</u> et al.
Jurisdiction:	United States District Court Eastern District of Texas Civil Action No. 6:2009-CV-00400-LED
Nature of Case/Notes:	Patent infringement US Patent 5487069.
Work Product:	On behalf of defendant Sony Corporation. Conducted independent technical analysis of claims, wrote rebuttal expert report against motion for infringement, deposed before opposing attorney.
Counsel:	Retained by White & Case LLP (lead: Warren Heit wheat@paloalto.whitecase.com)
Date:	2011. <u>Status -closed.</u>

Case: **Certain Electronic Devices, Including Mobile Phones and Tablet Computers, and Components Thereof**
Complainant- Nokia Corporation and Intellisync vs. HTC (Respondent) & Google (Intervenor)

Jurisdiction: United States International Trade Commission
Investigation No. 337-TA-847

Nature of Case/Notes Expert on behalf of Google (Intervenor) & HTC (Respondent)
Counsel: Retained by White & Case LLP on behalf of Google
(Lead: Shamita D. Etienne-Cummings
setienne@paloalto.whitecase.com)
Coordinated with
Counsel Barrington Dyer, McDermott, Will & Emery for HTC

Work Product Wrote Expert Witness report for Invalidity on behalf of Google. Deposed before opposing counsel.
Testified @ trial before ITC Judge Hon. Robert Pender (Jun. 2013)

Date: Aug. 2012 – July 2013. **Status- completed.**

Case: **In the Matter of Certain Wireless Communications Equipment and Articles Therein**
Complainant: Samsung Electronics Co. vs LM Ericsson

Jurisdiction: United States International Trade Commission
Investigation No. 337-TA-2126

Nature of Case/Notes Expert on behalf of respondents LM Ericsson
Counsel: McKool Smith LLP (Counsel:
Geoffrey Smith; gsmith@mckoolsmith.com)

Date: Feb. 2013 – July 2013

Work Product: Assisted Counsel for discovery of relevant prior art as part of non-infringement. **Status- closed.**

Case: **Intellectual Ventures LLC vs Motorola Mobility/Google**

Jurisdiction: US District Court – Southern District Florida
Case No. 13-CV-61358

Nature of Case/Notes Expert on behalf of respondents Motorola Mobility/Google
Counsel: Kilpatrick Townsend LLP (Counsels: Theodore Brown,
Jonathan Olinger, Rob Curylo, Akarsh Belagodu;
tbrown@kilpatricktownsend.com)

Date: Aug. 2013 – Sep. 2015.

Work Product: Assisting Counsel for Inter-Partes Review (IPR) for 3 patents.
Status IPR Declaration Filed, **Status – completed.**

Case: **C-Cation vs. Cisco**
Jurisdiction: Patent Trial & Appeals Board IPR 2014-00454
Nature of Case/Notes: Expert on behalf of respondents Cisco
Counsel: Kilpatrick Townsend LLP (Counsels: Patrick Njeim, Mike Pavento; pjneim@kilpatricktownsend.com)
Date: Jan 2014 – present
Work Product: Assisted Counsel for IPR
Status: IPR Declaration filed; **Status - Closed.**

Case: **DirectTV vs. ViXS**
Jurisdiction:
Nature of Case/Notes: Expert on behalf of respondents DirectTV
Counsel: Quinn Emanuel LLP (Counsels: Alan Whitehurst alanwhitehurst@quinnemanuel.com)
Date: Apr- Aug. 2014
Work Product: Assisted in discovery of prior art
Status: **Status: Closed (case settled)**

Case: **Commonwealth Scientific and Industrial Research Organization vs. Mediatek, Amazon et al.**
Jurisdiction: United States District Court Eastern District of Texas
Civil Action No. 6:2012-CV-578-LED
Nature of Case/Notes: Patent infringement US Patent 5487069.
Work Product: On behalf of defendant Amazon Corporation. Wrote expert report on non-infringement, deposed before opposing attorney.
Counsel: Retained by White & Case LLP (lead: Warren Heit wheit@paloalto.whitecase.com)
Date: Jan- Aug. 2015. **Status – Completed (case settled)**

Case: **NFC Tech. vs. Samsung Electronics Ltd. & Samsung Electronics America Inc.**
Jurisdiction: United States District Court Eastern District of Texas
Civil Action No. 2:15-cv-283-JRG-RSP
Nature of Case/Notes: Patent infringement US Patent 7905419.
Work Product: On behalf of defendant Samsung Electronics. Assisted with Claim Construction, wrote Invalidity Expert report.
Counsel: Retained by O'Melveny & Myers LLP (lead: Brian Cook, John Kappos, [bkook](mailto:bkook@omm.com), jkappos@omm.com)
Date: Oct. 2015- May 2016. **Status – Completed (case settled)**

Case:	<u>TCL Commn. Tech.</u> v. Ericsson
Jurisdiction:	U.S. Central District Court, CA Southern District Case 8:14-CV-00341-JVS-AN
Nature of Case/Notes:	Expert consultant for TCL on a set of 4G LTE patents for a FRAND case
Work Product:	Read Claim Charts and evaluated for potential infringement
Counsel:	Retained by Sheppard, Mullin, Richter & Hampton (lead: Nam Kim, nkim@sheppardmullin.com)
Date:	Sep. 2015- Dec. 2015.
Case:	<u>Barco NV</u> vs. Display Ten Tech. (via IMS Expert Services)
Nature of Case/Notes:	Potential US patent infringement
Work Product:	Visited Barco, examined product and wrote report exploring possible patent infringement strategy
Counsel:	Retained by Barnes & Thornburg LLP on behalf of Barco NV (lead: Jeffrey Morgan, jeff.morgan@btlaw.com)
Date:	Dec. 2015- Mar. 2016.
Nature of Work	Expert Consultant - Review of Wireless Patent Portfolio
Work Product:	Reviewed lapsing patents, provided expert opinion
Counsel:	Retained by Perkins Coie (Chris J. Daley-Watson, CDaleyWatson@perkinscoie.com)
Date:	Feb. 2017- Apr. 2017.
Case	<u>SIPCO</u> v Emerson 337-TA-1131
Jurisdiction	ITC
Nature of Case/Notes	Infringement of SIPCO patents re IEEE 802.15.4, Wireless HART, Zigbee standards
Work Product:	Assisted with review of products, patents, assisted with claim construction; Testified at ITC Trial (Judge Lord)
Counsel:	Retained by Finnegan, Henderson, Farabow, Garrett & Dunner (Greg Gramenopoulos, c.gregory.gramenopoulos@finnegan.com ; Karthik Kumar, Karthik.kumar@finnegan.com)
Date:	May 2018 – Sep. 2019 (completed)
Case	Sol IP LLC vs AT&T Mobility 2:18-cv-00526
Jurisdiction	Eastern District TX
Nature of Case/Notes	Retained on behalf of Ericsson NA
Work Product:	Assisted with review of patents, assisted with claim construction;

Counsel:	Retained by Winston & Strawn (M. Ruckheim, MRuckheim@winston.com; J. C. Masullo, JMasullo@winston.com)
Date:	May 2019 – Mar. 2020 <u>(completed)</u>
Case	UNM Rainforest Innovations vs Dell/ZyXEL Comm.
Jurisdiction	IPR2021-00375 before PTAB
Nature of Case/Notes	Retained on behalf of defendants (Dell/ZyXel)
Work Product:	Contributed to multiple expert declarations (3 patents)
Counsel:	Reed Smith (Peter Chassman, Jonathan Detrixhe@reedsmith.com)
Date:	Oct. 2021 – May 2022 <u>(completed)</u>
Case	NXP USA vs <u>MediaTek</u>
Jurisdiction	IPR2022-00911/00912 before PTAB
Nature of Work	Retained on behalf of plaintiff (MediaTek)
Work Product:	Contributed to expert declarations (2 patents)
Counsel:	Finnegan Henderson Farabow Garrett & Dunner (Houtan.Esfahani, Jason.Stach, Christopher.Johns@finnegan.com)
Date:	Mar. 2022 – Jun 2022 <u>(completed)</u>
Case:	Apple v <u>Ericsson</u> (Certain Mobile Phones and Tablet Computers, All With Switchable Connectivity)
Jurisdiction:	United States International Trade Commission 337-TA-1301
Nature of Work	Retained on behalf of Ericsson (plaintiff)
Counsel	Winston and Strawn, Fisher Broyles Louis Campbell (llcampbell@winston.com), Michael Murray (mike.murray@fisherbroyles.com)
Work Description:	multiple declarations (claim construction, expert report) deposition, Trial Testimony @ ITC before ALJ Hon. Cameron Elliott
Date	May – Nov 2022 <u>(completed)</u>
Case	Atlas Global vs <u>Sercomm/Asustek Inc</u>
Jurisdiction	6:21-cv-818 (WDTX) & IPR 2022-01519/01520
Work on Case	Retained on behalf of defendants (Sercomm/Asustek)
Counsel:	Steptoe & Johnson Christopher Suarez (csuarez@steptoe.com), Matthew Bathon (matthew.bathon@steptoe.com)
Work Description:	Assisted with multiple declarations (claim construction brief, expert declaration) for 2 patents
Date:	Mar 2022 – Mar 2023 <u>(completed)</u>

Case:	Panasonic v <u>Broadcomm</u> (6:22-cv-00755, 6:22-cv-00756)
Jurisdiction:	WDTX
Nature of Work	Retained on behalf of Broadcomm (defendant)
Counsel/Firm	Kilpatrick Townsend Ted Mayle (TMayle@kilpatricktownsend.com)
Work Description:	Assisted with Claim Construction, review infringement contentions
Date	Sep. 2022- Nov. 2023 (<u>completed</u>)
Case:	XR Communications v <u>Samsung</u> (6:21-cv-626)
Jurisdiction:	WDTX
Nature of Work	Retained on behalf of Samsung (defendant)
Counsel/Firm	Arnold Porter Ruifeng Pu(Ruifeng.Pu@arnoldporter.com), Atanas Baitchev (Atanas.Baitchev@arnoldporter.com), Michael Shamouilian (Michael.Shamouilian@arnoldporter.com)
Work Description:	Review Infringement contentions, help with Invalidity charts Invalidity Prior art review, Draft Invalidity Report
Date	Aug. 2022 – Feb. 2023 (<u>completed</u>)
Case:	AX Wireless v <u>Lenovo</u> (6:22-cv-280)
Jurisdiction:	EDTX
Nature of Work	Retained on behalf of Lenovo (defendant)
Counsel/Firm	Kilpatrick Townsend Ted Mayle (TMayle@kilpatricktownsend.com)
Work Description:	Review infringement contentions
Date	Mar. 2023- Jul 2023 (<u>completed</u>)
Case:	Neo Wireless v <u>VW Group America</u> (2:22-cv-11404)
Jurisdiction:	EDTN
Nature of Work	Retained on behalf of VW Group (defendant)
Counsel/Firm	Sterne, Kessler, Goldstein & Fox Timothy Tang (TTang@sternekessler.com) Ryan Richardson (RRichardson@sternekessler.com)
Work Description:	Assisted with Non-infringement Contentions
Date	Apr-May 2023 (<u>completed</u>)