EXHIBIT I

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

PEGASUS WIRELESS INNOVATION LLC, *Plaintiff*, v. CELLCO PARTNERSHIP d/b/a VERIZON WIRELESS *et al.,* *Defendants*.	§	Case No. 2:23-cv-00640-JRG (Lead Case)
CELLCO PARTNERSHIP d/b/a VERIZON WIRELESS, *Counterclaim-Plaintiff*, v. PEGASUS WIRELESS INNOVATION LLC and KT CORPORATION, *Counterclaim-Defendants*.	§	Case No. 2:23-cv-00640-JRG (Lead Case)
PEGASUS WIRELESS INNOVATION LLC, *Plaintiff*, v. AT&T CORP. *et al.,* *Defendants*.	§	Case No. 2:23-cv-00638-JRG (Member Case)
NEW CINGULAR WIRELESS PCS, LLC, *Counterclaim-Plaintiff*, v. PEGASUS WIRELESS INNOVATION LLC and KT CORPORATION, *Counterclaim-Defendants*.	§	Case No. 2:23-cv-00638-JRG (Member Case)

PEGASUS WIRELESS INNOVATION LLC, *Plaintiff*, v. T-MOBILE USA, INC. *et al.,* *Defendants*.	§	Case No. 2:23-cv-00639-JRG (Member Case)
T-MOBILE USA, INC., *Counterclaim-Plaintiff*, v. PEGASUS WIRELESS INNOVATION LLC and KT CORPORATION, *Counterclaim-Defendants*.	§	Case No. 2:23-cv-00639-JRG (Member Case)

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Pursuant to P.R. 3-3, P.R. 3-4, and the Docket Control Order (Dkt. No. 68) and the Court's Order granting the parties Joint Motion to Modify Case Deadlines (Dkt. No. 20), Defendants AT&T Corp., AT&T Services, Inc., AT&T Mobility LLC, AT&T Mobility II LLC, New Cingular Wireless PCS, LLC, Cricket Wireless LLC, Cellco Partnership d/b/a Verizon Wireless, Verizon Business Network Services LLC, Verizon Corporate Services Group Inc., TracFone Wireless, Inc., T-Mobile USA, Inc., Sprint Solutions LLC, and Sprint Spectrum LLC (collectively, the "Defendants") hereby provide their Amended Invalidity Contentions with respect to the claims identified by Plaintiff Pegasus Wireless Innovation LLC ("Pegasus" or the "Plaintiff") in its Disclosures Pursuant to Local Patent Rules 3-1 and 3-2 (March 21, 2024) ("Infringement Contentions").

I. PRELIMINARY STATEMENT AND RESERVATION OF RIGHTS

A. The Asserted Claims

According to the Infringement Contentions, Pegasus asserts the following patents, claims, and priority dates against each of the Defendants.

Patent	Asserted Claims	Asserted Priority Date
11,627,631 (the "'631 patent")	All Defendants: 1–18	"November 3, 2016, as well as the dates of any subsequent applications"
10,181,931 (the "'931 patent")	All Defendants: 1–7	"September 27, 2013, as well as the dates of any subsequent applications"
10,616,932 (the "'932 patent")	All Defendants: 1–2, 4, 8–9, 11	"July 14, 2015, as well as the dates of any subsequent applications"
11,405,942 (the "'942 patent")	All Defendants: 1–3, 5–7, 9–11	"November 16, 2016, as well as the dates of any subsequent applications"
10,594,460 (the "'460 patent")	All Defendants: 1–12	"July 28, 2017, as well as the dates of any subsequent applications"
10,721,118 (the "'118 patent")	All Defendants: 1–3, 6–12, 15	"May 12, 2016, as well as the dates of any subsequent applications"
11,219,000 (the "'000 patent")	All Defendants: 1–12	"September 29, 2017, as well as the dates of any subsequent applications"

Patent	Asserted Claims	Asserted Priority Date
10,638,463 (the "'463 patent")	All Defendants: 1–9	"September 29, 2017, as well as the dates of any subsequent applications"
11,540,272 (the "'272 patent")	All Defendants: 1–20	"October 31, 2016, as well as the dates of any subsequent applications"
9,894,644 (the "'644 patent")	All Defendants: 1–3	"September 26, 2013, as well as the dates of any subsequent applications"
10,009,161 (the "'161 patent")	All Defendants: 1–6	"March 21, 2014, as well as the dates of any subsequent applications"

Defendants contend that each of the Asserted Claims are invalid at least one or more of 35 U.S.C. §§ 102, 103, or 112.[1] Pursuant to the Patent Rules, Defendants do not provide any contentions regarding any claims not asserted by Plaintiff. To the extent that the Court permits Plaintiff to assert additional claims against Defendants, Defendants reserve all rights to amend or supplement these Amended Invalidity Contentions or to otherwise disclose new or supplemental invalidity contentions regarding such claims. Furthermore, because discovery is ongoing,[2] Defendants reserve the right to revise, amend, and/or supplement the information provided herein, including identifying, charting, and relying on additional references, should discovery yield additional information or references.

[1] To the extent that discovery reveals that the patentee did not invent the subject matter of the Asserted Patents or otherwise derived the claimed subject matter from another, Defendants reserve the right to assert derivation under 35 U.S.C. § 101 which is distinct from subject-matter eligibility.

[2] Defendants' ongoing efforts include but are not limited to: serving subpoenas on prior artists and inventors regarding prior art, seeking additional information related to the references and systems disclosed in these Amended Invalidity Contentions, and seeking additional information related to available prior art systems, as well as Plaintiff's Infringement Contentions and the products accused of infringing therein. No depositions have been taken as of this time, including, without limitation, depositions of any inventors, authors, or entities listed on any references or systems identified in these Amended Invalidity Contentions. Further, Defendants reserve the right to review and supplement these Amended Invalidity Contentions with respect to any additional prior art that becomes apparent as discovery proceeds.

Defendants further reserve the right to amend these contentions in response to any claim construction rulings, as permitted by the Patent Rules or with permission of the Court.

The Infringement Contentions are deficient in multiple respects and do not provide Defendants with sufficient information to understand the specific accused features and components and the alleged factual and evidentiary bases for the Plaintiff's infringement allegations. Among other things, the Infringement Contentions lack the specificity required by P.R. 3-1, fail to properly identify accused instrumentalities, and fail to explain adequately Plaintiff's infringement theories for numerous claim elements. Plaintiff has prejudiced Defendants' ability to understand, for purposes of preparing these Amended Invalidity Contentions, what Plaintiff alleges to be the scope of the Asserted Claims. If Plaintiff modifies any assertion or contention in its Infringement Contentions or presents any new assertion or contention relevant to these Amended Invalidity Contentions to the extent allowed by the Patent Rules or the Court, Defendants reserve the right to supplement or otherwise amend these Amended Invalidity Contentions.

B. Priority Date of the Asserted Patents

Plaintiff's Infringement Contentions contain allegations regarding the priority date to which Plaintiff alleges it is entitled for each of the Asserted Claims. *See, e.g.*, Pegasus's Infringement Contentions at 10. Defendants do not agree that Plaintiff is entitled to the alleged priority date for each of the Asserted Claims.

Any reference to an "asserted priority date" in these Amended Invalidity Contentions refers to the priority date identified in Plaintiff's Infringement Contentions. Reference to a "priority date" or an "asserted priority date" should not be construed to mean that Defendants agree that the Asserted Patent is in fact entitled to such priority date, or that Plaintiff has provided proper notice

as to its contentions relating to the priority date.[3] To the extent Plaintiff alleges that any prior art relied on in these Amended Invalidity Contentions does not actually qualify as prior art to an Asserted Patent, Defendants reserve the right to rebut those allegations (*e.g.*, by demonstrating an earlier critical date for the challenged prior art and/or a later priority date for a particular Asserted Patent and/or Asserted Claim).[4] Likewise, to the extent Plaintiff successfully establishes a priority date before any of the prior-art references relied upon by Defendants, then those references serve as evidence of secondary considerations of obviousness, particularly, contemporaneous invention by others.

C. Claim Construction

Because the Court has not yet construed any terms of the Asserted Claims, Defendants' Amended Invalidity Contentions are based on (1) Defendants' present understanding of the Asserted Claims, and (2) the claim constructions Plaintiff appears to be proposing based on the Infringement Contentions, all without regard to whether Defendants agree with Plaintiff's apparent or expressed claim constructions. Defendants reserve the right to supplement or otherwise amend these Amended Invalidity Contentions in response to any proposed claim constructions or alleged supporting evidence offered by Plaintiff, any report from any expert witness for Plaintiff regarding claim construction issues, any claim construction briefing filed by Plaintiff, and any position taken by Plaintiff concerning claim construction, infringement, or invalidity.

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[3] Defendants reserve the right to rely on additional documents and evidence, including without limitation the documents cited in Pegasus's Infringement Contentions, in the event that Pegasus fails to establish that any Asserted Claim of any Asserted Patent is entitled to its Asserted Priority Date.

[4] Defendants reserve the right to rely on additional documents and evidence to rebut any efforts by Plaintiff to allege any reference was not publicly available or otherwise available as prior art.

Defendants take no position on any matter of claim construction in these Amended Invalidity Contentions. If Defendants' apparent claim construction herein are consistent with any explicit, apparent, or implied claim constructions in the Infringement Contentions, no inference is intended, and no inference should be drawn that Defendants agree with any of Plaintiff's claim constructions. Any statement herein describing or tending to describe any claim element is provided solely for the purpose of understanding and/or applying the cited prior art. Defendants expressly reserve the right to (1) propose any claim construction Defendants consider appropriate, (2) contest any claim construction proposed by Plaintiff that Defendants consider inappropriate or inaccurate, and/or (3) take positions with respect to claim construction issues that are inconsistent with, or even contradictory to, claim construction positions expressed or implied in these Amended Invalidity Contentions.

Prior art not included in these Amended Invalidity Contentions, whether or not now known to Defendants, might become relevant depending on the claim constructions proposed by Defendants and/or the Court's claim construction rulings. Defendants reserve all rights to supplement or modify the positions and information in these Amended Invalidity Contentions, including without limitation the prior art and grounds of invalidity set forth herein, pursuant to P.R. 3-6 after the Court has construed the Asserted Claims.

D. Ongoing Discovery and Supplementation

Defendants' investigation, including its investigation of prior art and grounds for invalidity, is ongoing. Furthermore, Defendants' invalidity positions will be the subject of expert testimony. Defendants base these Amended Invalidity Contentions on their current knowledge and understanding of the Asserted Claims, Plaintiff's Infringement Contentions, the prior art, and other facts and information available as of the date of these contentions.

Defendants reserve the right to supplement these Amended Invalidity Contentions, including, without limitation, by adding additional prior art and grounds of invalidity in accordance with the Federal Rules of Civil Procedure, the Local Rules, the Patent Rules, the Docket Control Order, and any Order issued by this Court, or otherwise.

E. Prior Art Identification and Citations Thereto

In these Amended Invalidity Contentions, Defendants identify specific portions of prior art references that disclose the elements of each of the Asserted Claims. While Defendants have identified exemplary prior art references for each element, they do not necessarily identify every disclosure of the same element in each prior art reference. A person of ordinary skill in the art would read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field and would rely upon other information, including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references, other publications and prior art products, and expert testimony to provide context and to aid in understanding and interpretation of the identified portions of the prior art.

Defendants also reserve the right to rely upon (1) other portions of the cited prior art references, other publications, prior art products, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including on the basis of modifying or combining certain cited references; (2) admissions relating to prior art in the Asserted Patents or related patents, the prosecution history of the Asserted Patents or related patents, or other admissions obtained during discovery; and (3) foreign counterparts of any U.S. patents identified in Defendants' Amended Invalidity Contentions.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure as well as any text

relating to the figure in the remainder of the prior art reference (*e.g.*, for patent references, text in the specification and prosecution history). Similarly, where an identified portion of text refers to a figure or other material, the identification of text should be understood to include the referenced figure or other material.

All related prior art references that are themselves subparts or related documents of a broader set of documents, such as all references that form part of a single release of an industry standard, such as ETSI standards, should be considered a single prior art reference, as that is how a person of ordinary skill in the art would consider such related references.

F. Invalidity, Unenforceability, and/or Ineligibility Based on Non-Required Disclosure(s)

Defendants reserve the right to prove the invalidity, unenforceability, and/or ineligibility of one or more of each of the Asserted Claims on bases other than those required by P.R. 3-3 to be disclosed in these disclosures.

G. No Patentable Weight

Defendants reserve the right to argue that various portions of each of the Asserted Claims, such as an intended use or result, non-functional descriptive material, and certain preamble language, are entitled to no patentable weight. Mapping of a portion of an Asserted Claim to a prior art reference does not represent that such portion of the claim is entitled to patentable weight when comparing the claimed subject matter to the prior art.

II. INVALIDITY CONTENTIONS

As explained herein and in Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits D-1–D-9, Exhibits E-1–E-12, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8, and Appendixes A–K, Defendants contend that each of the Asserted Claims is invalid under 35 U.S.C. §§ 102, 103, and/or 112.

A. P.R. 3-3(a) – Identification of Prior Art

Pursuant to P.R. 3-3(a), and subject to Defendants' reservation of rights as stated herein, Defendants identify the prior art that anticipates and/or renders obvious the Asserted Claims of the Asserted Patents in the tables set forth below.[5] On information and belief, each listed reference qualifies as prior art to the Asserted Patents.

To the extent that any of the following are prior art, Defendants reserve the right to rely upon foreign counterparts of the U.S. patents identified herein; U.S. counterparts of foreign patents and foreign patent applications identified herein; and U.S. and foreign patents and patent applications corresponding to articles and publications identified herein. Defendants also reserve the right to rely upon parent or ancestor patents or patent applications from which any of the patents or patent applications identified herein claim priority to as continuation, divisional, or continuation-in-part applications. Identification of dates of publication are made based on currently available information, and Defendants reserve the right to rely upon an earlier date should evidence supporting an earlier date be discovered.

1. The '631 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[6]
U.S. Patent No. 11,356,854	United States	June 7, 2022
U.S. Patent No. 10,966,222	United States	March 30, 2021
U.S. Patent No. 11,765,635	United States	September 19, 2023

[5] Defendants also hereby identify any systems or products that embody the technology described in any patent or publication identified in these Amended Invalidity Contentions. Defendants reserve the right to rely on any documents or other evidence regarding such systems.

[6] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Patent/Publication No.	Country of Origin	Date of Issue/Publication[6]
U.S. Patent No. 10,893,455	United States	January 12, 2021
U.S. Patent No. 11,240,724	United States	February 1, 2022
U.S. Patent Appl. Publ. No. 2011/0274087	United States	March 3, 2015
U.S. Patent Appl. Publ. No. 2019/0349803	United States	November 14, 2019
U.S. Patent Appl. Publ. No. 2014/0135007	United States	May 15, 2014
U.S. Patent No. 9,681,355	United States	June 13, 2017
U.S. Patent No. 10,952,275	United States	March 16, 2021
U.S. Patent No. 11,076,434	United States	July 27, 2021
U.S. Patent Appl. Publ. No. 2007/0293254	United States	December 20, 2007
U.S. Patent Appl. Publ. No. 2009/0252070	United States	October 8, 2009
U.S. Patent Appl. Publ. No. 2014/0086177	United States	June 27, 2017

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
3GPP TSG RAN WG3 #95bis; R3-171116 Nokia, Alcatel-Lucent Shanghai Bell "Connected Mode Mobility with Slicing"	March 24, 2017
3GPP TSG RAN WG3 #97; R3-173152 Huawei "Xn Based Mobility Across RA"	August 11, 2017
3GPP TSG RAN WG3 #95bis; R3-171029 ZTE "NW Slice Availability Handling Approaches During Mobility"	March 25, 2017
3GPP TR 38.801 V0.4.0 (2016-08) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on New Radio Access Technology; Radio Access Architecture and Interfaces (Release 14)	September 13, 2016
3GPP TSG RAN WG3 NR-adhoc; R3-170065 ZTE "Selection RAN Part Network Slice During UE Mobility"	January 7, 2017
3GPP TSG RAN WG3 #97bis; R3-173614 CATT "Discussion on Slice Mobility Issue"	September 30, 2017
3GPP TS 36.300 V13.4.0 (2016-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 13)	July 7, 2016

2. The '931 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[7]
U.S. Patent Appl. Publ. No. 2014/0219202	United States	August 7, 2014
U.S. Patent Appl. Publ. No. 2015/0156722	United States	June 4, 2015
U.S. Patent No. 11,470,619	United States	October 11, 2022
U.S. Patent Appl. Publ. No. 2013/0310016	United States	November 21, 2013
U.S. Patent No. 9,716,988	United States	July 25, 2017
U.S. Patent No. 10,123,332	United States	November 6, 2018
U.S. Patent No. 9,596,683	United States	March 14, 2017
Chinese Patent No. CN102348269	China	February 8, 2012
U.S. Patent No. 9,319,203	United States	April 19, 2016
U.S. Patent Appl. Publ. No. 2016/0127952	United States	May 5, 2016
U.S. Patent Appl. Publ. No. 2014/0092790	United States	April 3, 2014
U.S. Patent No. 9,510,132	United States	November 29, 2016
U.S. Patent Appl. Publ. No. 2014/0328230	United States	February 8, 2022

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
3GPP TR 36.888 V12.0.0 (2013-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on provision of low-cost MTC UEs based on LTE; (Release 12)	June 26, 2013
3GPP TSG-RAN WG1 #72bis; R1-131181 MediaTek Inc. "Coverage Analysis of PUSCH and Enhancement Techniques for MTE UEs"	April 4, 2013
3GPP TS 36.213 v11.3.0 (2013-06) Evovled Universal Terrestrial Radio Access (E-UTRA) Physical Layer Procedures (Release 11)	June 26, 2013
3GPP TSG RAN WG1 #74; R1-133062 ZTE "Discussion on Repetition for Control Channel and Traffic Channel"	August 10, 2013
3GPP TSG RAN WG1 #70; R1-123619 Ericsson, ST-Ericsson "PUCCH resource allocation for ePDCCH"	August 5, 2012

[7] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Title, Author(s), and Publisher.	Date of Publication
3GPP TSG-RAN WG1 #70bis; R1-124122 Intel Corporation "PUCCH resource allocation"	September 29, 2012
3GPP TSG-RAN WG1 #70bis; R1-124190 Nokia Siemens Networks, Nokia "Remaining issues on HARQ-ACK resource allocation for data scheduled via EPDCCH TDD aspects	September 29, 2012
3GPP TSG-RAN WG1 Meeting #72bis; R1-131466 Ericsson, ST-Ericsson "Coverage enhancements for MTC – on the need for PUCCH"	April 5, 2013
3GPP TSG-RAN WG1 #73; R1-132021 Ericsson, ST-Ericsson "Coverage Enhancements for MTC – conclusions and recommendations"	May 11. 132013
3GPP TSG-RAN WG1 #74; R1-132971 Alcatel-Lucent, Alcatel-Lucent Shanghai Bell "Coverage enhancement for PRACH"	August 10, 2013
3GPP TSG-RAN WG1 #74; R1-133156 Intel Corporation "Discussion on PUCCH coverage enhancements for low-cost MTC"	August 10, 2013
3GPP TSG-RAN WG1 #74; R1-133285 MediaTek Inc. "Discussion on the functionality of PHICH and PUCCH for coverage enhancement"	August 10, 2013
3GPP TSG-RAN WG1 #74; R1-133370 LG Electronics "Initial procedure and consideration points for the coverage enhancement of MTC UEs"	August 10, 2013
3GPP TSG-RAN WG1 #74; R1-133421 Ericsson, ST-Ericsson "Control of amount of coverage enhancement for MTC UE"	August 10, 2013
3GPP TSG RAN WG1 #74; R1-133922 Huawei, HiSilicon "Way Forward on the LS for new UE category and additional coverage improvement to RAN2"	August 23, 2013
3GPP TS 36.331 v11.5.0 (2013-09) "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) (Release 11)	September 19, 2013

3. The '932 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[8]
U.S. Patent No. 10,257,881	United States	April 9, 2019
U.S. Patent No. 9,807,752	United States	October 31, 3017
U.S. Patent No. 10,728,876	United States	July 28, 2020
U.S. Patent Pub. No. 2014/0056243	United States	February 27, 2014
U.S. Patent Pub. No. 2014/0126527	United States	May 8, 2014
U.S. Patent No. 10,869,342	United States	December 15, 2020
International Publication WO2015/140038	France	September 24, 2015
International Publication WO2016/005002	Finland	January 14, 2016
International Publication WO2014/071882	China	May 15, 2014
International Publication WO2015/046352	Japan	April 2, 2015

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
R2-134005	November 1, 2013
R2-152770	May 19, 2015
R2-151482	April 11, 2015

4. The '942 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[9]
U.S. Patent Appl. Publ. No. 2017/0223687	United States	September 11, 2018
U.S. Patent Appl. Publ. No. 2019/0268930	United States	August 29, 2019
U.S. Patent Appl. Publ. No. 2018/192434	United States	July 5, 2018
U.S. Patent Appl. Publ. No. 2018/0092104	United States	March 29, 2018

[8] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

[9] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Patent/Publication No.	Country of Origin	Date of Issue/Publication[9]
U.S. Patent Appl. Publ. No. 2018/0092104	United States	March 29, 2018
U.S. Patent Appl. Publ. No. 2019/0165882	United States	November 24, 2020
U.S. Patent Appl. Publ. No. 2019/0123883	United States	December 21, 2018
U.S. Patent Appl. Publ. No. 2020/03672116	United States	January 24, 2023
U.S. Patent Appl. Publ. No. 2018/041858	United States	February 8, 2018
U.S. Patent Appl. Publ. No. 2023/0037317	United States	February 9, 2023
U.S. Patent Appl. Publ. No. 2021/0152312	United States	May 20, 2021
U.S. Patent Appl. Publ. No. 2016/0234857	United States	August 11, 2016

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
R1-1612646: On multiplexing of eMBB and URLLC data (Interdigital)	November 5, 2016
R1-1609050: Numerology for URLLC (Samsung)	September 30, 2016
R1-1611545: Dynamic Resource Sharing for eMBB/URLLC in DL (Sony)	October 10, 2016
R1-1612316: Scheduling and support for service multiplexing (Interdigital)	November 5, 2016
R1-1608957: URLLC and eMBB frame structure and multiplexing (ZTE)	October 1, 2106
R1-166408: Multiplexing of eMBB and URLLC (ZTE)	August 13, 2016
R1-1613047: Dynamic Resource Sharing for eMBB/URLLC in DL (Sony)	November 10, 2016

5. The ’460 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[10]
U.S. Patent No. 9,762,357	United States	September 12, 2017
U.S. Patent No. 10,548,123	United States	January 28, 2020
U.S. Patent No. 10,749,644	United States	August 18, 2020

[10] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Patent/Publication No.	Country of Origin	Date of Issue/Publication[10]
U.S. Patent No. 10,873,435	United States	December 22, 2020
U.S. Patent No. 11,012,209	United States	May 18, 2021
U.S. Patent No. 11,431,464	United States	August 30, 2022
U.S. Patent No. 11,677,521	United States	June 13, 2023
U.S. Patent No. 11,677,528	United States	June 13, 2023
U.S. Patent Appl. Publ. No. 2016/0381681	United States	December 29, 2016
U.S. Patent Appl. Publ. No. 2020/0136778	United States	April 30, 2020
U.S. Patent Appl. Publ. No. 2020/0336269	United States	October 22, 2020
U.S. Patent Appl. Publ. No. 2020/0389204	United States	December 10, 2020
WO 2018/203727	Republic of Korea	November 8, 2018
WO 2018/129085 ("Yin")	United States	July 12, 2018
U.S. Patent Publication No. 2013/0322493	United States	December 5, 2013

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
"3G Evolution HSPA and LTE for Mobile Broadband" (Second Edition), E. Dahlman, S. Parkvall, J. Skold, P. Beming, Academic Press	October 3, 2008
"Frequency Hopping in LTE Uplink," Tariku Mehari, Blekinge Institute of Technology	March 2009
3GPP TS 36.213 v14.2.0 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 14)	June 23, 2017
3GPP TS 38.214 v15.1.0 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for data (Release 15)	April 9, 2018
3GPP TS 38.213 v15.1.0 (2018-03) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for control (Release 15)	April 8, 2018
R1-1710878, Bandwidth Adaptation via BWP Selection in NR, InterDigital, Inc.	June 16, 2017
R1-1719015, Summary of offline discussions for PUCCH resource allocation until 11th Oct.	October 13, 2017
R1-1721380, Review Summary for Al 7.3.2.2. PUCCH structure in long-duration, Huawei, HiSilicon	November 28, 2017
R1-1801080, Offline Summary for AI 7.3.3.4 UL data transmission procedure, NTT Docomo, Inc.	January 24, 2018

Title, Author(s), and Publisher.	Date of Publication
3GPP TS 36.211 v11.6.0 (2014-09) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (Release 11) at §5.3.4	September 26, 2014

6. The '118 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[11]
U.S. Patent Appl. Publ. No. 2015/0119048	United States	April 30, 2015
International Publication WO2015/070445	China	May 21, 2015
U.S. Patent Appl. Publ. No. 2016/0249389	United States	August 25, 2016
U.S. Patent Appl. Publ. No. 2016/0212753	United States	November 22, 2016
U.S. Patent Appl. Publ. No. 2015/0117183	United States	June 6, 2017
U.S. Patent No. 11,038,859	United States	June 15, 2021
U.S. Patent Appl. Publ. No. 2016/0380779	United States	December 29, 2016
U.S. Patent Appl. Publ. No. 2017/0331670	United States	May 13, 2016
U.S. Patent No. 9,961,606	United States	May 1, 2018
U.S. Patent Appl. Publ. No. 2015/0131578	United States	May 14, 2015
U.S. Patent Appl. Publ. No. 2015/0208235	United States	July 23, 2015
U.S. Patent Appl. Publ. No. 2015/0264562	United States	September 17, 2015
U.S. Patent Appl. Publ. No. 2016/0029362	United States	January 28, 2016
U.S. Patent Appl. Publ. No. 2016/0044639	United States	February 11, 2016
International Publication WO2016005002	Europe	January 14, 2016
International Publication WO2016047904	Korea	March 31, 2016
International Publication WO2016006936	Korea	June 1, 2018
U.S. Patent No. 10,952,099	United States	March 16, 2021

[11] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
3GPP TSG RAN WG2 #85bis; R2-141109 CMCC "RRC Reconfiguration Failure in Dual Connectivity"	March 21, 2014
3GPP TSG RAN WG2 #83bis; R2-133392 Fujitsu "Discussion on SRB via SeNB for Dual Connectivity"	September 27, 2013
3GPP TSG RAN WG2 #85; R2-140059 Huawei, HiSilicon "The Order and Direction of Messages for SeNB"	February 1, 2014
3GPP TSG RAN WG2 #87bis; R2-144867 Nokia "Remaining Details for SCG Failure Reporting"	November 7, 2014
3GPP TSG RAN WG2 #94; R2-163764 MediaTek "Architecture for Standalone NR and LTE-NR Tight Interworking"	May 13, 2016
3GPP TSG RAN WG2 #87bis; R2-144363 Nokia "Remaining Details for SeNB Failure Reporting"	September 26, 2014
Dual Connectivity for LTE-advanced Heterogeneous Networks, Want et al., Wireless Networks	August 7, 2015
3GPP TSG RAN WG2 #85; R2-140199 MediaTek Inc. "System Information Delivery for SCG"	January 31, 2014
3GPP TSG RAN WG2 #93bis; R2-162413 MediaTek Inc. "Tight Interaction Between NR and LTE"	April 1, 2016
3GPP TSG RAN WG2 #93bis; R2-162889 NEC "Tight Interworking Between NR and LTE"	April 2, 2016
3GPP TS 36.300 version 12.8.0 Release 12	January 4, 2016

7. The '000 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[12]
U.S. Patent No. 9,674,831	United States	June 6, 2017
U.S. Patent No. 9,485,060	United States	November 1, 2016
U.S. Patent No. 10,736,085	United States	August 4, 2020
U.S. Patent No. 10,805,941	United States	October 13, 2020
U.S. Patent No. 10,305,664	United States	May 28, 2019

[12] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Patent/Publication No.	Country of Origin	Date of Issue/Publication[12]
U.S. Patent No. 11,133,971	United States	September 28, 2021
U.S. Patent No. 10,980,007	United States	April 13, 2021
U.S. Patent Appl. Pub. No. 2020/0374866	United States	November 26, 2020
U.S. Patent Appl. Pub. No. 2020/0163085	United States	May 21, 2020
U.S. Patent Appl. Pub. No. 2020/0252180	United States	August 6, 2020
U.S. Patent Appl. Pub. No. 2019/0239214	United States	August 1, 2019
U.S. Patent Appl. Pub. No. 2019/0044689	United States	February 7, 2019
U.S. Patent Appl. Pub. No. 2020/0228287	United States	July 16, 2020
U.S. Patent Appl. Pub. No. 2017/0265176	United States	September 14, 2017
U.S. Patent Appl. Pub. No. 2016/0338041	United States	November 17, 2016
U.S. Patent Appl. Pub. No. 2017/0086219	United States	March 23, 2017
U.S. Patent Appl. Pub. No. 2014/0056278	United States	February 27, 2014
International Pub. No. WO 2018/227538	China	December 20, 2018
International Pub. No. WO 2019/030929	Japan	February 14, 2019
International Pub. No. WO 2017/024554	China	February 16, 2017

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
3GPP TSG-RAN WG1 #89, R1-1709802, Ericsson et al., "Way Forward on bandwidth part for efficient wideband operation in NR"	May 19, 2017
3GPP TSG RAN WG1 #90, R1-1714079, Nokia, Nokia Shanghai Bell, "PUCCH resource allocation"	August 11, 2017
3GPP TSG RAN WG1 #90, R1-1713181, LG Electronics, "Consideration on resource allocation for NR-PUCCH"	August 12, 2017
3GPP TSG RAN WG1 Ad-Hoc#1, R1-1711853, Ericsson et al., "Activation/deactivation of bandwidth part"	June 29, 2017

8. The '463 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[13]
U.S. Patent No. 9,674,831	United States	June 6, 2017
U.S. Patent No. 9,485,060	United States	November 1, 2016
U.S. Patent No. 10,736,085	United States	August 4, 2020
U.S. Patent No. 10,805,941	United States	October 13, 2020
U.S. Patent No. 10,305,664	United States	May 28, 2019
U.S. Patent No. 11,133,971	United States	September 28, 2021
U.S. Patent No. 10,980,007	United States	April 13, 2021
U.S. Patent Appl. Pub. No. 2020/0374866	United States	November 26, 2020
U.S. Patent Appl. Pub. No. 2020/0163085	United States	May 21, 2020
U.S. Patent Appl. Pub. No. 2020/0252180	United States	August 6, 2020
U.S. Patent Appl. Pub. No. 2019/0239214	United States	August 1, 2019
U.S. Patent Appl. Pub. No. 2019/0044689	United States	February 7, 2019
U.S. Patent Appl. Pub. No. 2020/0228287	United States	July 16, 2020
U.S. Patent Appl. Pub. No. 2017/0265176	United States	September 14, 2017
U.S. Patent Appl. Pub. No. 2016/0338041	United States	November 17, 2016
U.S. Patent Appl. Pub. No. 2017/0086219	United States	March 23, 2017
U.S. Patent Appl. Pub. No. 2014/0056278	United States	February 27, 2014
International Appl. Pub. No. WO 2018/227538	China	December 20, 2018
International Pub. No. WO 2019/030929	Japan	February 14, 2019
International Pub. No. WO 2017/024554	China	February 16, 2017

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
3GPP TSG-RAN WG1 #89, R1-1709802, Ericsson et al., "Way Forward on bandwidth part for efficient wideband operation in NR"	May 19, 2017
3GPP TSG RAN WG1 #90, R1-1714079, Nokia, Nokia Shanghai	August 11, 2017

[13] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Title, Author(s), and Publisher.	Date of Publication
Bell, "PUCCH resource allocation"	
3GPP TSG RAN WG1 #90, R1-1713181, LG Electronics, "Consideration on resource allocation for NR-PUCCH"	August 12, 2017
3GPP TSG RAN WG1 Ad-Hoc#1, R1-1711853, Ericsson et al., "Activation/deactivation of bandwidth part"	June 29, 2017

9. The '272 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[14]
U.S. Patent Appl. Publ. No. 2018/0041325	United States	February 8, 2018
U.S. Patent Appl. Publ. No. 20180376497	United States	December 27, 2018
U.S. Patent Appl. Publ. No. 2018/192434	United States	July 5, 2018
U.S. Patent No. 11,005,628	United States	February 9, 2017
U.S. Patent Appl. Publ. No. 2014/0328260	United States	November 11, 2014
U.S. Patent No. 9,345,017	United States	July 30, 2015
U.S. Patent Appl. Publ. No. 2017/0170940	United States	June 15, 2017
U.S. Patent Appl. Publ. No. 2016/0330721	United States	November 10, 2016
U.S. Patent Appl. Publ. No. 2016/0295584	United States	October 6, 2016
U.S. Patent Appl. Publ. No. 2019/0165882	United States	May 30, 2019
U.S. Patent Appl. Publ. No. 2019/0123883	United States	December 21, 2018
U.S. Patent Appl. Publ. No. 2020/0260526	United States	August 13, 2020
U.S. Patent Appl. Publ. No. 2021/0282157	United States	September 9, 2021
U.S. Patent Appl. Publ. No. 2013/452276	United States	August 16, 2012
U.S. Patent Appl. Publ. No. 2020/0187169	United States	June 11, 2020
PCT/KR2012/007967	Korea	April 14, 2013
US13/981,847	United States	February 27, 2014
US2011051654A1	United States	March 3, 2011
US20120218952A1	United States	August 30, 2012
US20130336197A1	United States	December 19, 2013
US20140334430A1	United States	November 13, 2014

[14] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Patent/Publication No.	Country of Origin	Date of Issue/Publication[14]
US20150208394A1	United States	July 23, 2015
US20150304995A1	United States	October 22, 2015
US20130272261A1	United States	October 17, 2013
US20150358111A1	United States	December 10, 2015
KR20150084759A	Korea	October 26, 2020
PCT/SE2015/050953	SE	March 17, 2016
PCT/KR2016/003797	Korea	October 13, 2016
International Publication WO2017196059	Korea	November 2, 2017

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.211 version 12.9.0 Release 12)	April 2017
LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.212 version 12.5.0 Release 12)	July 2015
3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (Release 13)	September 2016
A Low Computational Complexity Realization Algorithm for DVRB Mapping to DPRB in TD-LTE System	July 2013
Efficient Control Signaling for Resource Allocation in OFDMA Networks, Ku et. al., IEEE	June 2014
Resource Allocation and Link Adaptation in LTE and LTE Advanced: A Tutorial, Ku et. al., IEEE	December 18, 2014
R1-165652: WF on NPDCCH ordered PRACH (Ericsson)	May 23, 2016
R1-1609509: NR frame structure for forward compatibility (Intel)	October 1, 2016
R1-1609050: Numerology for URLLC (Samsung)	September 30, 2016
R1-162345: Discussion on non-precoded CSI-RS design for eFD-MIMO (ZTE)	April 11, 2016
R1-161028: Discussion on Resource Allocation and Scheduling of NB-PDSCH (ITL)	February 15, 2016
3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial	March 29, 2016

Title, Author(s), and Publisher.	Date of Publication
Radio Access (E-UTRA); Multiplexing and channel coding (3GPP TS 36.212 version 13.1.0 Release 13)	
3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (3GPP TS 36.213 V13.1.0 Release 13)	March 29, 2016
3GPP T-Doc R1-1610129: Summary of [86-19] Discussion on Slot Structure Use Cases (Qualcomm Incorporated)	October 10, 2016

10. The '644 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[15]
EP 2,337,260	EP	June 22, 2011
EP 2,835,990	EP	February 11, 2015
U.S. Patent Appl. Pub. No. 2011/01228245	United States	May 26, 2011
U.S. Patent Appl. Pub. No. 2011/0222491	United States	September 15, 2011
U.S. Patent Appl. Pub. No. 2012/0028668	United States	February 2, 2012
U.S. Patent Appl. Pub. No. 2012/0320782	United States	December 20, 2012
U.S. Patent Appl. Pub. No. 2013/0301542	United States	November 14, 2013
U.S. Patent App. Pub. No. 2013/0114570	United States	May 9, 2013
U.S. Patent App. Pub. No. 2014/0071915	United States	March 13, 2014
U.S. Patent App. Pub. No. 2014/0161084	United States	June 12, 2014
U.S. Patent Appl. Pub. No. 2016/0353420	United States	December 1, 2016
WO2012/169800	Korea	December 13, 2012
WO2012/173432	Korea	December 20, 2012
WO2013/012221	Korea	January 24, 2013
WO2015/018075	China	February 12, 2015
WO2014/055878	United States	April 10, 2014

[15] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
R1-125404 36.213 CR 0396 (3GPP)	November 30, 2012
R1-130938 PBCH coverage extension for MTC devices (Alcatel-Lucent, Alcatel-Lucent Shanghai Bell)	April 15-19, 2013
R1-132973 Coverage enhancement for (E)PDCCH (Alcatel-Lucent, Alcatel-Lucent Shanghai Bell)	August 19-23, 2013
R1-132283 EPDCCH impact on UE demodulation performance - EPDCCH test scenarios (Intel Corporation)	May 20-24, 2013
3GPP TS 36.213 V 9.1.0 (2010-04)	April 2010
3GPP TS 22.368 V 12.2.0 (2013-03)	March 2013

11. The '161 Patent

a) Identification of Prior Art Patents and Patent Publications

Patent/Publication No.	Country of Origin	Date of Issue/Publication[16]
WO2015/103630 ("Kwon 630")	United States	July 9, 2015
WO2014/194681 ("Xia 681")	China	December 11, 2014
U.S. Patent No. 9,860,091 ("Larsson 091")	United States	January 2, 2018
U.S. Patent No. 9,001,845 ("Enescu")	United States	April 7, 2015
U.S. Patent Appl. Pub. No. 2014/0192732 ("Chen 732")	United States	July 10, 2014
U.S. Patent Appl. Pub. No. 2016/0249244 ("Xia 244")	United States	August 25, 2016
U.S. Patent Appl. Pub. No. 2016/0226623 ("Olsson")	United States	August 4, 2016
U.S. Patent Appl. Pub. No. 2015/0381310 ("Hammarwall")	United States	December 31, 2015
U.S. Patent Appl. Pub. No. 2015/0372784 ("Xu 784")	United States	December 24, 2015
U.S. Patent Appl. Pub. No. 2015/0163773 ("Wang 773")	United States	June 11, 2015

[16] For any patent that claims the benefit of provisional application(s), Defendants may rely on the provisional application(s), for purposes of establishing invalidity. Defendants may also rely upon the date of filing of any issued patent or patent application to show the priority of that reference.

Patent/Publication No.	Country of Origin	Date of Issue/Publication[16]
U.S. Patent Appl. Pub. No. 2014/0241201 ("Kim 201")	United States	August 28, 2014

b) Identification of Prior Art Publications

Title, Author(s), and Publisher.	Date of Publication
Further Details on CQI Table Design (R1-141529) ("Nokia 529")	March 21, 2014
Further Discussion on CQI/MCS Table Design for 256QAM (R1-141120) ("Huawei 120")	March 22, 2014
CQI/MCS Table Design for 256QAM (R1-140034) ("Huawei 034")	February 1, 2014
3GPP TS 36.213 V 12.0.0 (2013-12) ("TS 36.213")	December 20, 2013
Consideration on Higher Order Modulation for Small Cell (R1-130136) ("ZTE 136")	January 19, 2013
On CQI/MCS/TBS table design for 256QAM (R1-140555) ("Nokia 555")	January 31, 2014
CQI Table Design for Downlink 256QAM (R1-140753) ("Ericsson 753")	February 1, 2014
Details of CQI Table Design for High Order Modulation (R1-140609) ("Broadcom 609")	February 1, 2014
Evaluation and Discussion on Mechanism to Support 256QAM (R1-140521) ("Hitachi 521")	February 1, 2014
Specification of 256QAM (R1-140160) ("Alcatel 160")	February 1, 2014
On Standard Impacts of 256QAM in Downlink (R1-140258) ("ZTE 258")	February 1, 2014
Higher Order Modulation (R1-140451) ("Qualcomm 451")	February 1, 2014
CQI/MCS/TBS Tables for 256QAM and Relevant Signaling (R1-140118) ("Intel 118")	February 1, 2014
Discussion on CQI/MCS Table Design for 256QAM (R1-141366) ("FiberHome 366")	March 21, 2014
Consideration of Implementation Issues for 256QAM (R1-132058) ("Alcatel 058")	May 11, 2013
Standard Impacts of 256QAM (R1-135033) ("Huawei 033")	November 1, 2013
Vienna LTE Simulators, LTE-A Link Level Simulator Documentation, v1.2 ("Vienna Link Level Simulator")	June 25, 2010
Simulating the Long Term Evolution Physical Layer, Mehlfuhrer C. et al., EUSIPCO 2009 (Aug. 24-28, 2009) ("Mehlfuhrer 2009")	August 24, 2009

Title, Author(s), and Publisher.	Date of Publication
The Vienna LTE Simulators – Enabling Reproducibility in Wireless Communications Research, Mehlfuhrer C. et al., EURASIP J on Advances in Signal Processing (2011) ("Mehlfuhrer 2011")	December 2011
System Level Simulation of LTE Networks, Ikuno J. et al., VTC2010-Spring (May 16-19, 2010) ("Ikuno 2010")	May 16, 2010
A Novel MCS Selection Criterion for VOIP in LTE, Ding L. et al., 7th Intl Conference on Wireless Commc'ns (Sept. 23-25, 2011) ("Ding 2011")	September 23, 2011
LTE – The UMTS Long Term Evolution From Theory to Practice, Sesia S. et al. (2011 2d ed.) ("LTE Book")	2011
CQI Table Design to Support 256 QAM in Small Cell Environment, Mu Q. et al., International Conference on Wireless Commc'ns and Signal Processing (2013) ("Mu")	October 24, 2013
Simulator for the LTE Link Level Performance Evaluation, Kitanov S., ACT Innovations 2011 Web Proceedings ("Kitanov")	September 2011
Summary of AH session on AI 6.4.5 "UE Procedures for downlink shared channel," ("R1-075069")	November 13, 2007
A Novel CQI Calculation Scheme in LTE\LTE-A Systems, Chen X et al. (2011) ("Chen 2011")	2011

12. Identification of Prior Art Sales/Public Uses for the Asserted Patents

Item Offered for Sale and/or Publicly Used	Date of Offer or Public Use	Person or Entity who Made and Received Offer, Made Public Use, or Made Information Known
Nokia base station equipment		Nokia
Ericsson base station equipment		Ericsson
All systems or products that embody the technology described in any patent or publication identified in these Amended Invalidity Contentions		

B. P.R. 3-3(b) – Anticipation and Obviousness

Pursuant to P.R. 3-3(b), and subject to Defendants' reservation of rights, Defendants attach claim charts hereto that are direct to the prior art references that anticipate each of the Asserted Claims of the Asserted Patent under 35 U.S.C. § 102(a), either expressly or inherently, and/or the

prior art references that, in the alternative, would have rendered the Asserted Claims obvious under 35 U.S.C. § 103. *See* Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits D-1–D-9, Exhibits E-1–E-12, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8, and Appendices A–K. Some claim charts also contain explanations about the motivation to combine the references. Any combinations contained or reference cited herein may be combined with any other reference to demonstrate the invalidity of any of the Asserted Claims, as set forth below and in Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits D-1–D-9, Exhibits E-1–E-12, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8, and Appendices A–K.

To the extent any claim limitation is construed to have a similar meaning, or to encompass similar feature(s) and/or function(s), as any other claim limitation, the citations to prior art references for each of those claim limitations in Defendants' claim charts are incorporated by reference with respect to each other.

Defendants' claim charts provide exemplary citations to the prior art references that teach or suggest every element of each of the Asserted Claims. To the extent that an element of an Asserted Claim is not shown in a chart, the Asserted Claims would have been obvious based on a combination of one or more other prior art references, as set forth below in Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits D-1–D-9, Exhibits E-1–E-12, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8, and Appendices A–K, or in view of the knowledge of one of ordinary skill in the art.

Much of the art cited in these Amended Invalidity Contentions reflects common knowledge and the state of the art at the time of the earliest filing date of the Asserted Patents. Defendants

may rely on additional citations, references, expert testimony, and other material to provide context or to aid in understanding the cited portions of the references and/or cited features of the systems. Defendants also may rely on expert testimony explaining relevant portions of references, relevant hardware or software products or systems, and other discovery regarding these subject matters. Additionally, Defendants may rely on other portions of any prior art reference or other references relied on by the same authors or describing the same systems for purposes of explaining the background and general technical subject matter of the reference.

Where an individual reference is cited with respect to all elements of an Asserted Claim, Defendants contend that the reference anticipates the claim under 35 U.S.C. § 102(a) and also renders obvious the claim under 35 U.S.C. § 103, both by itself and in view of the knowledge of a person of ordinary skill in the art and in combination with the other cited references to the extent the reference is not found to disclose one or more claim elements. A single prior art reference, for example, can establish obviousness where the differences between the disclosures within the reference and the claimed invention would have been obvious to one of ordinary skill in the art. For example, "[c]ombining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness." *Boston Scientific Scimed, Inc. v. Cordis Corp*., 554 F.3d 982, 991 (Fed. Cir. 2009). To the extent Plaintiff contends that an embodiment within a particular item of prior art does not fully disclose all limitations of a claim, Defendants accordingly reserve their rights to rely on other embodiments in that prior art reference, or other information, to show single reference obviousness under 35 U.S.C. § 103.

Where an individual reference is cited with respect to fewer than all elements of an Asserted Claim, Defendants contend that the reference renders obvious the claim under 35 U.S.C. § 103 in view of each other reference and combination of references that discloses the remaining

claim element(s), as indicated in the claim charts submitted herewith. "Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966)).

Exemplary motivations to combine references are discussed below and in the accompanying charts. Defendants reserve the right to rely upon any references or assertions identified herein in connection with Defendants' contentions that each Asserted Claim is invalid under 35 U.S.C. § 103 and to rely upon expert testimony addressing such references and assertions. The fact that prior art is identified to anticipate the Asserted Claims presents no obstacle in also relying on that reference as a basis for invalidity based on obviousness. It is established that "a rejection for obviousness under § 103 can be based on a reference which happens to anticipate the claimed subject matter." *In re Meyer*, 599 F.2d 1026, 1031 (C.C.P.A. 1979). To the extent any cited prior art item may not fully disclose a limitation of an Asserted Claim or is alleged by Plaintiff to lack disclosure of the limitation, such limitation is present and identified in another prior art item as shown in the attached claim charts.

Many of the cited references cite or relate to additional references and/or products, services, or projects. Many of the cited references also cite software, hardware, or systems. Defendants might rely upon such cited additional references and/or products and copies or exemplars of such software, hardware, or systems. Defendants will produce or make available for inspection any such cited references, products, software, hardware, or systems that they intend to rely upon. Defendants

may also rely upon the disclosures of the references cited and/or discussed during the prosecution of the Asserted Patents and/or the assertions presented regarding those references.

Defendants reserve the right to further streamline and reduce the number of anticipation or obviousness references relied upon with respect to a given Asserted Claim and to exchange or otherwise modify the specific references relied upon for anticipation and within each obviousness combination for each Asserted Claim.

C. P.R. 3-3(c) – Claim Charts

Defendants attach the following claim charts pursuant to P.R. 3-3(c):

1. The '631 Patent

Claim Chart Exhibit	Prior Art Reference
A-1	R3-173152 - Xn Based Mobility Across RA ("R3-173152")
A-2	U.S. Patent No. 10,966,222 ("Han 222")
A-3	U.S. Patent No. 11,765,635 ("Futaki 635")
A-4	3GPP TR 38.801 V0.4.0 (2016-08) ("TR 38.801 V0.4.0")
A-5	U.S. Patent No. 11,356,854 ("Futaki 854")
A-6	U.S. Patent No. 10,893,455 ("Zee")
A-7	U.S. Patent No. 11,240,724 ("Han 724")
A-8	U.S. Patent Pub. No. 2011/0274087 ("Liang")
A-9	U.S. Patent Pub. No. 2019/0349803 ("Byun")
A-10	U.S. Patent Pub. No. 2014/0135007 ("Yu")
A-11	R3-171116 Connected Mode Mobility with Slicing ("R3-171116")
A-12	R3-171029 - NW Slice Availability Handling Approaches During Mobility ("R3-171029")
A-13	R3-170065 - Selection RAN Part Network Slice During UE Mobility ("R3-170065")
A-14	R3-173614 - Discussion on Slice Mobility Issue ("R3-173614")
A-15	3GPP TS 36.300 V13.4.0 (2016-06) ("TS 36.300 V13.4.0")

2. The '931 Patent

Claim Chart Exhibit	Prior Art Reference
B-1	US 2016/0127952 A1 ("You")
B-2	US 2014/0219202 A1 ("Kim")

Claim Chart Exhibit	Prior Art Reference
B-3	US 9,319,203 B2 ("Yang")
B-4	US 11,470,619 ("Lee")
B-5	3GPP TSG RAN WG1 #74; R1-133062 ZTE "Discussion on Repetition for Control Channel and Traffic Channel" ("ZTE")
B-6	US 2014/0092790 A1 ("Zhang")
B-7	3GPP TSG RAN WG1 #74; R1-133922 Huawei, HiSilicon "Way Forward on the LS for new UE category and additional coverage improvement to RAN2" ("Huawei")
B-8	3GPP TS 36.213 v11.3.0 (2013-06) Evovled Universal Terrestrial Radio Access (E-UTRA) Physical Layer Procedures (Release 11) ("TS 36.213 v.11.3.0")
B-9	3GPP TSG RAN WG1 #70; R1-123619 Ericsson, ST-Ericsson – "PUCCH resource allocation for eDPCC" ("Ericsson")

3. The '932 Patent

Claim Chart Exhibit	Prior Art Reference
C-1	U.S. Patent No. 10,257,881 ("Lin '881")
C-2	U.S. Patent No. 9,807,752 ("Zhang '752")
C-3	U.S. Patent No. 10,728,876 ("Lin '876")
C-4	U.S. Patent Pub. No. 2014/0056243 ("Xiong")
C-5	U.S. Patent No. 10,869,342 ("Zhang '342")
C-6	R2-134005

4. The '942 Patent

Claim Chart Exhibit	Prior Art Reference
D-1	US20170223687A1 ("Kuchibhotla")
D-2	US20190268930A1 ("Rudolf")
D-3	US2018192434A1 ("Lee")
D-4	US201662372195P ("Sheng")
D-5	R1-1612646 ("Interdigital")
D-6	R1-1609050 ("Samsung")
D-7	US20190165882A1 ("You")
D-8	US20190123883A1 ("Islam")
D-9	US20210152312A1 (Xiong)

5. The '460 Patent

Claim Chart Exhibit	Prior Art Reference
E-1	3GPP TS 38.213 v15.1.0 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for control (Release 15) ("TS 38.213")
E-2	3GPP TS 38.214 v15.1.0 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for data (Release 15) ("TS 38.214")
E-3	"3G Evolution HSPA and LTE for Mobile Broadband" (Second Edition), E. Dahlman, S. Parkvall, J. Skold, P. Beming, Academic Press ("Dahlman")
E-4	"Frequency Hopping in LTE Uplink," Tariku Mehari, Blekinge Institute of Technology ("Mehari")
E-5	3GPP TS 36.213 v14.2.0 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 14) ("TS 36.213")
E-6	U.S. Patent Pub. 2020/0136778 ("Takeda")
E-7	U.S. Patent No. 10,548,123 ("Ouchi")
E-8	U.S. Patent Pub. 2020/0336269 ("Shen")
E-9	U.S. Patent Pub. 2020/0389204 ("Matsumura")
E-10	WO 2018/203727 ("Zhang")
E-11	3GPP TSG RAN WG1 NR Ad Hoc Meeting (Vancouver, Canada), R1-1801080, Offline summary for AI 7.3.3.4 UL data transmission procedure, NTT Docomo, Inc. ("R1-1801080")
E-12	WO 2018/129085 A1 ("Yin")

6. The '118 Patent

Claim Chart Exhibit	Prior Art Reference
F-1	U.S. Patent Pub. No. 2015/0119048 ("Yang")
F-2	WO 2015/070445 ("Zhang")
F-3	U.S. Patent Pub. No. 2016/0249389 ("Takahashi")
F-4	R2-141109 - RRC Reconfiguration Failure in Dual Connectivity ("R2-141109")
F-5	U.S. Patent Pub. No. 2016/0212753 ("Wu")
F-6	U.S. Patent Pub. No. 2015/0117183 ("Heo")
F-7	U.S. Patent No. 11,038,859 ("Velde")
F-8	U.S. Patent Pub. No. 2016/0380779 ("Sharma")
F-9	U.S. Patent Pub. No. 2017/0331670 ("Parkvall")

Claim Chart Exhibit	Prior Art Reference
F-10	R2-133392 - Discussion on SRB via SeNB for Dual Connectivity ("R2-133392")
F-11	R2-140059 - The Order and Direction of Messages for SeNB ("R2-140059")
F-12	R2-144867 - Remaining Details for SCG Failure Reporting ("R2-144867")
F-13	U.S. Patent No. 10,952,099 ("Futaki")

7. The '000 Patent

Claim Chart Exhibit	Prior Art Reference
G-1	U.S. Patent No. 10,305,664 ("Ahn")
G-2	U.S. Patent Pub. No. 2016/0338041 ("LI")
G-3	U.S. Patent Pub. No. 2017/0265176 ("Marinier")
G-4	U.S. Patent No. 9,485,060 ("Nayeb Nazar")
G-5	U.S. Patent No. 10,805,941 ("Shaheen")
G-6	U.S. Patent Pub. No. 2020/0374866 ("Takeda I")
G-7	U.S. Patent Pub. No. 2020/0163085 ("Takeda II")
G-8	U.S. Patent Pub. No. 2020/0252180 ("Takeda III")
G-9	U.S. Patent No. 10,736,085 ("Yan")
G-10	U.S. Patent Pub. No. 2019/0239214 ("Yang")
G-11	International Patent Pub. No. WO 2018/227538 ("Zhang")
G-12	3GPP TSG-RAN WG1 #89, R1-1709802, Ericsson et al., "Way Forward on bandwidth part for efficient wideband operation in NR" ("R1-1709802")
G-13	3GPP TSG RAN WG1 #90, R1-1713181, LG Electronics, "Consideration on resource allocation for NR-PUCCH" ("R1-1713181")
G-14	3GPP TSG RAN WG1 #90, R1-1714079, Nokia, Nokia Shanghai Bell, "PUCCH resource allocation" ("R1-1714079")
G-15	3GPP TSG RAN WG1 Ad-Hoc#1, R1-1711853, Ericsson et al., "Activation/deactivation of bandwidth part"
G-16	U.S. Patent No. 10,980,007 ("Oh")

8. The '463 Patent

Claim Chart Exhibit	Prior Art Reference
H-1	U.S. Patent No. 10,305,664 ("Ahn")
H-2	U.S. Patent Pub. No. 2016/0338041 ("LI")

Claim Chart Exhibit	Prior Art Reference
H-3	U.S. Patent Pub. No. 2017/0265176 ("Marinier")
H-4	U.S. Patent No. 9,485,060 ("Nayeb Nazar")
H-5	U.S. Patent No. 10,805,941 ("Shaheen")
H-6	U.S. Patent Pub. No. 2020/0374866 ("Takeda I")
H-7	U.S. Patent Pub. No. 2020/0163085 ("Takeda II")
H-8	U.S. Patent Pub. No. 2020/0252180 ("Takeda III")
H-9	U.S. Patent No. 10,736,085 ("Yan")
H-10	U.S. Patent Pub. No. 2019/0239214 ("Yang")
H-11	International Patent Pub. No. WO 2018/227538 ("Zhang")
H-12	3GPP TSG-RAN WG1 #89, R1-1709802, Ericsson et al., "Way Forward on bandwidth part for efficient wideband operation in NR" ("R1-1709802")
H-13	3GPP TSG RAN WG1 #90, R1-1713181, LG Electronics, "Consideration on resource allocation for NR-PUCCH" ("R1-1713181")
H-14	3GPP TSG RAN WG1 #90, R1-1714079, Nokia, Nokia Shanghai Bell, "PUCCH resource allocation" ("R1-1714079")
H-15	3GPP TSG RAN WG1 Ad-Hoc#1, R1-1711853, Ericsson et al., "Activation/deactivation of bandwidth part"
H-16	U.S. Patent No. 10,980,007 ("Oh")

9. The '272 Patent

Claim Chart Exhibit	Prior Art Reference
I-1	US20180041325A1 ("Lee '325")
I-2	US20180376497A1 ("You")
I-3	US2018192434A1 ("Lee '434")
I-4	US11005628B2 ("Cheng")
I-5	US20140328260A1 ("Papasakelleriou")
I-6	US9345017B2 ("Park")
I-7	US20200187169A1 ("Gao")

10. The '644 Patent

Claim Chart Exhibit	Prior Art Reference
J-1	International Publication No. WO 2015/018075 ("Zhuang")
J-2	U.S. Patent Application Publication No. 2014/0161084 ("Yang-084")
J-3	European Patent Application Publication No. EP 2,835,990 ("Baker")
J-4	U.S. Patent Application Publication No. 2011/0222491

Claim Chart Exhibit	Prior Art Reference
	("Vajapeyam")
J-5	U.S. Patent Application Publication No. 2012/0028668 ("Lee-668")
J-6	U.S. Patent Application Publication No. 2012/0122825 ("Lee-825")
J-7	U.S. Patent Application Publication No. 2014/0071915 ("Papasakellariou-915")
J-8	International Publication No. WO 2014/055878 ("Lee-878")

11. The '161 Patent

Claim Chart Exhibit	Prior Art Reference
K-1	CQI/MCS Table Design for 256QAM (R1-140034) ("Huawei 034")
K-2	Further Details on CQI Table Design (R1-141529) ("Nokia 529")
K-3	WO2014/194681 ("Xia 681")
K-4	U.S. Patent Appl. Pub. No. 2014/0192732 ("Chen 732")
K-5	U.S. Patent No. 9,860,091 ("Larson 091")
K-6	WO2015/103630 ("Kwon 630")
K-7	Further Discussion on CQI/MCS Table Design for 256QAM (R1-141120) ("Huawei 120")
K-8	3GPP TS 36.213 V12.0.0 (2013-12) ("TS 36.213")

The attached claim charts are based, in whole or in part, on Pegasus's asserted theories of infringement in this case, to the extent discernible from Pegasus's Infringement Contentions. As an initial matter, all portions of each prior art reference cited in each of the attached claim charts are relied upon to support the disclosure of each patent claim limitation, as all portions provide general support. Representative descriptions and supporting citations are nevertheless provided, but are merely exemplary; they do not necessarily reflect every instance where a particular claim term or claim limitation may be disclosed in or taught by the prior art reference. References to figures or drawings refer to the figures/drawings themselves, as well as to any accompanying text or text necessary to understand the figures or drawings. References to the text refers to the text itself, as well as the accompanying figures or drawings that accompany the text. Defendants reserve the right to rely on additional or different portions of the prior art references, other

publications, and expert testimony to establish what these references would have taught one of ordinary skill in the art, or in what manner they would have motivated a particular combination of references. Moreover, in certain instances, representative documents for certain prior art systems are cited, but, again, are merely exemplary; they do not necessarily reflect or include every document relating to the prior art system that exists and that discloses or teaches a particular claim term or claim limitation. Defendants reserve the right to rely on any and all documents that describe or relate to prior art systems, including relying on the system itself. Defendants also reserve the right to rely on the testimony of the authors, named inventors, or anyone else with knowledge of the prior art references and systems identified herein, as well as expert testimony regarding any such references or systems.

D. Obviousness and Motivation to Combine

The primary references identified above and as further described in Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits D-1–D-9, Exhibits E-1–E-12, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8 each discloses, either expressly or inherently, every element of the Asserted Claims, thereby anticipating those claims. To the extent Plaintiff contends that any primary reference does not anticipate the Asserted Claims, it would have been obvious to combine or modify the primary references with concepts from other prior art, as explained herein and in the following appendices:

Asserted Patent	Appendix
’631 patent	A
’931 patent	B
’932 patent	C
’942 patent	D
’460 patent	E
’118 patent	F
’000 patent	G

’463 patent	H
’272 patent	I
’644 patent	J
’161 patent	K

In particular, for each limitation of the Asserted Claims that Pegasus contends is not met by a particular primary reference, Defendants contend that the limitation (and the claim as a whole) is obvious based on a combination of that particular primary reference with (1) any other primary reference disclosing that limitation, (2) any admitted prior art, as explained in the background of each patent or discussed in the file history, (3) any reference identified in Appendices A–K as disclosing that limitation, (4) the knowledge of a person of ordinary skill in the art, and/or (5) any of the references and concepts discussed herein regarding the relevant background and state of the art. The specific combinations of prior art that Defendants contend render the Asserted Claims obvious are readily determinable as described herein, which is the most efficient manner of identifying the combinations in light of the fact that Pegasus has asserted 117 claims across eleven patents. Defendants’ obviousness grounds for each dependent claim incorporate the obviousness grounds for the claim(s) from which the dependent claim depends in addition to any obviousness grounds identified in the charts for the dependent claim.

Defendants do not yet have the benefit of Pegasus’s positions on the prior art, including what (if any) elements it contends are missing in each prior art reference, whether Pegasus agrees that a reference is in fact prior art, and whether Pegasus agrees that a person of ordinary skill in the art would be motivated to combine specific references. Defendants reserve the right to supplement these obviousness positions (including identifying additional prior art combinations and the associated reasons to combine) as discovery in the case progresses, including expert discovery.

1. Background and State of the Art

Defendants set forth below a summary of their current understanding of the state of the art as understood as of the asserted priority dates of the Asserted Patents for the general subject matter of each of the Asserted Patents. The information discussed in this section may have formed the background knowledge of a person of ordinary skill in the art at the time the Asserted Patents were filed and may have been used in determining whether and how to combine references to achieve the claimed inventions. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (stating that "the knowledge [of a person of ordinary skill in the art] is part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious"). Defendants expressly reserve the right to rely on each of the prior art references, systems, concepts, and technologies discussed in this Section with respect to each of the Asserted Patents.

Defendants contend that, to the extent the primary references identified in these Amended Invalidity Contentions do not anticipate the Asserted Claims, it would have been obvious to combine any of the references, systems, concepts, or technologies discussed in this Section with those primary references. Defendants also reserve the right to rely on the discussions of the state of the art and prior art in each of the Asserted Patent specifications and their file histories including foreign file histories of related patents in explaining the state of the art. Defendants further expressly reserve the right to supplement their summary of the background and state of the art, including, for example, with information from any of the authors or named inventors on any of the prior art references, by personnel familiar with systems based on any of the prior art references, or any prior art systems related to prior art references, or by technical experts retained on behalf of any party. Defendants also expressly reserve the right to rely on any admissions by any of the named inventors, institutions with which they were associated, and Pegasus, regarding the state of the art.

a) Background and State of the Art Related to the '631 Patent

The following section describes the background and state of the art related to the '631 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '631 patent's earliest alleged priority date. The interpretation of the features of the '631 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a method for transmitting and receiving data, a controller for transmitting and receiving data, and an apparatus for transmitting and receiving data. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for elements 1[pre], 7[pre], and 13[pre], for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of deciding, by a source base station (BS), whether to perform a handover, to decide whether to perform a handover, and a controller configured to decide whether to perform a handover. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614; including the portions identified in A-1–A-15 and Appendix A for element 1[a], 7[b], and 13[a], for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting, from the source BS to a target BS, a handover request message when it is decided to perform the handover, to transmit a handover request message when it is decided to perform the handover, and a transmitter configured to transmit a handover request message when it is decided to perform the handover. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-

170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 1[b], 7[c], and 13[b], for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the handover request message includes network slice information. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 1[c], 7[d], and 13[c], for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving, by the source BS from the target BS, a handover request confirmation message in response to the handover request message, to receive a handover request confirmation message in response to the handover request message, and a receiver configured to receive a handover request confirmation message in response to the handover request message. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 1[d], 7[e], and 13[d], for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by the target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 1[e], 7[f], and 13[e], for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving, by the source BS from a user equipment (UE), a non-access stratum (NAS) message including network slice request information, the processor further performs to receive a non-access stratum (NAS) message including network slice request information, and the processor further performs to receive a non-access stratum (NAS) message including network slice request information. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 2, 8, and 14, for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving, by the source BS from a core network entity, the network slice information, wherein the network slice information is configured by the network slice request information, the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information, and the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 3, 9, and 15, for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the NAS message including the network slice request information is included in a radio resource control (RRC) connection setup completion message. *See, e.g.*, R3-

173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 4, 10, and 16, for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the network slice information is configured by the core network entity based on the network slice request information. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 5, 11, and 17, for example.

Prior to the '631 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the transmission of the handover request message is performed through a direct interface associated with the target base station. *See, e.g.*, R3-173152, Han 222, Futaki 635, TR 38.801 V0.4.0, Futaki 854, Zee, Han 724, Liang, Byun, Yu, R3-171116, R3-171029, R3-170065, R3-173614, TS 36.300 V13.4.0; including the portions identified in A-1–A-15 and Appendix A for element 6, 12, and 18, for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for transmitting and receiving data ('631 patent at 1:31-36); service-oriented next generation mobile communication networks ('631 patent at 1:44-46); network slicing ('631 patent at 1:44-47, 7:33-57); accommodating mobile service with various requirements ('631 patent at 1:48-49); guarantee quality of an end-to-end service to user equipment ('631 patent at 1:49-50); transmission/reception through a microcell or base station ('631 patent at 5:45-46); radio resource control (RRC) signaling ('631 patent at 6:12-

14); network service configured by utilizing resources of a network in which a user equipment is connected to the network through a base station (’631 patent at 7:27-30).

b) Background and State of the Art Related to the ’931 Patent

The following section describes the background and state of the art related to the ’931 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the ’931 patent’s earliest alleged priority date. The interpretation of the features of the ’931 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior the ’931 patent’s earliest priority date, a person of ordinary skill in the art would have been aware of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal and configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[pre] and 3[pre], for example.

Prior the ’931 patent’s earliest priority date, a person of ordinary skill in the art would have been aware of receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel and transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[a] and 3[a], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of receiving downlink control information for scheduling the downlink data and transmitting downlink control information for scheduling the downlink data. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[b] and 3[b], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of receiving the downlink data and transmitting the downlink data. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[c] and 3[c], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of transmitting the response information on the downlink data by using the resource allocated to the uplink control channel. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for element 1[d], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel and the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control

channel. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[e], 3[d], and 7[c] for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal and the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[f], 3[e], 5[d], and 7[d], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station and a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[g], 3[f], 5[e], and 7[e], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[h], 3[g], 5[f], 7[f], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 1[i], 3[h], 5[g], 7[g], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of a Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station and base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 5[pre] and 7[pre], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for element 5[a].

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data. *See* You, Kim, Yang,

Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for element 7[a].

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for element 7[b], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for element 5[b] for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for elements 5[c], for example.

Prior the '931 patent's earliest priority date, a person of ordinary skill in the art would have been aware of at least one of the plurality of pieces of start offset information is applied according

to a corresponding coverage level of the MTC terminal. *See* You, Kim, Yang, Lee, ZTE, Zhang, Huawei, TS 36.213 v.11.3.0, Ericsson; including the portions identified in B-9 and Appendix B for claims 2, 4, and 6, for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for Machine Type Communication (MTC) (*see, e.g.,* '931 Patent at 1:65-2:1, 3:63-4:6); receiving structural information ('931 Patent at 2:1-6); receiving downlink control information for scheduling the downlink data ('931 Patent at 2:6-7); receiving downlink data ('931 Patent at 2:7-8); transmitting structural information ('931 Patent at 2:20-25); transmitting downlink control information for scheduling the downlink data ('931 Patent at 2:25-26); transmitting the downlink data ('931 Patent at 2:26-27); uplink and downlink transmit control information through control channels ('931 Patent at 5:33-35); Physical Downlink Control Channel (PDCCH) ('931 Patent at 5:35); Physical Downlink Shared Channel (PDSCH) ('931 Patent at 5:39); the control information may be transmitted by means of the EPDCCH (enhanced PDCCH or extended PDCCH) ('931 Patent at 5:43-45); Hybrid Automatic Repeat Request (HARQ) ACK/NACK feedback ('931 Patent at 6:41-43); a base station ('931 Patent at 4:23-28); Time Division Duplex (TDD) ('931 Patent at 5:26-28), Frequency Division Duplex ('931 Patent at 5:28-30); allocating a PUCCH resource for the uplink HARQ ACK/NACK feedback of the MTC terminal ('931 Patent at 7:64-67; 7:37-63).

c) Background and State of the Art Related to the '932 Patent

The following section describes the background and state of the art related to the '932 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '932 patent's earliest alleged priority date. The

interpretation of the features of the '932 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit receiving a first uplink RRC message from a UE. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 1[a], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit transmitting the first uplink RRC message to a central unit. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 1[a], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit receiving a second downlink RRC message from the central unit in response to the first uplink RRC message. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 1[b], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit forwarding a second downlink RRC message to the UE. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 1[c], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit and central distinguishing SRBs based on radio bearer identification information in the first and second message. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 1[d], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit comprising a node configured to provide an RLC function, a MAC function, and a PHY function for transmission of user plane data. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 2[pre], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of an access unit comprising a node configured to provide an RLC function, a MAC function, and a PHY function for transmission of user plane data. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 2[pre], for example.

Prior to the '932 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a second downlink RRC message which consists of either an RRC connection setup message, a C-RNTI, or signaling radio bearer identification information. *See, e.g.*, Lin '881, Zhang, Lin '876; including the portions identified in C-1–C-6 and Appendix C for element 4[a], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation various types of communication services ('932 patent at 4:20-5:34); transceiving data to/from a Base Station by the User Equipment ('932 patent at 4:4-16); transceiving data to/from the User Equipment by the Base Station ('932 patent at 4:4-16); transmitting control information through control channels, such as a Physical Downlink Control Channel (PDCCH), an Enhanced PDCCH (EPDCCH), a Physical Control Format Indicator Channel (PDFICH), a Physical Hybrid ARQ Indicator Channel (PHICH), a Physical Uplink

Control Channel (PUCCH), and the like ('932 patent at 4:40-53); transmitting data on data channels, such as a Physical Downlink Shared Channel, a Physical Uplink Shared Channel, and the like ('932 patent at 4:40-53); communications between base stations ('932 at 4:60-5:6); "receiving an uplink radio resource control (RRC) message from a terminal, including the uplink RRC message into a first message, and transmitting the first message to a central unit" ('932 FH, 08-21-2019 Response to Office Action at 5-7); "receiving a second message from the central unit, where the second message includes a downlink RRC message in response to the uplink RRC message from the terminal" ('932 FH, 08-21-2019 Response to Office Action at 5-7); "transmitting the downlink RRC message to the terminal" ('932 FH, 08-21-2019 Response to Office Action at 5-7).

d) Background and State of the Art Related to the '942 Patent

The following section describes the background and state of the art related to the '942 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '942 patent's earliest alleged priority date. The interpretation of the features of the '942 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting by a base station (BS) and receiving a by a user equipment (UE) a downlink (DL) signal. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 1[pre], 5[pre], and 9[pre], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of configuring and transmitting, by the BS, and receiving, by the UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information. *See,*

e.g., Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for element 1[a], 5[a], 5[b], and 9[a], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for element 1[b] and 9[b], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting, from the BS, and receiving, by the UE, the DL preemption indication information based on the specific RNTI through a multicast signal. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for element 1[c], 5[c], and 9[c], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI). *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 1[d], 5[d], and 9[d], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You,

and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 1[e], 5[e], and 9[e], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein the specific RNTI is received with information related to time and frequency. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 1[f], 5[f], and 9[f], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 1[g], 5[g], and 9[g], for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 2[a], 6[a], or 10[a] for example.

Prior to the '942 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein the DL preemption indication information is received through a common search space of the DL control channel. *See, e.g.*, Kuchibhotla, Rudolf, Lee, Sheng, InterDigital, Samsung, You, and Islam; including the portions identified in D-1 – D-9 and Appendix D for elements 3[a], 7[a], and 11[a], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for frame structures ('942 Patent at 1:31-42); channel coding and modulation ('942 Patent at 1:31-42); waveforms ('942 Patent at 1:31-42); multiple access methods ('942 Patent at 1:31-42); improving data transmission rate ('942 Patent at 1:31-42); enhanced mobile broadband (eMBB) ('942 Patent at 1:43-55); massive machine-type communication (mMTC) ('942 Patent at 1:43-55); ultra-reliable and low latency communication (URLLC) ('942 Patent at 1:43-55); preemption and allocation of resources ('942 Patent at 1:56-67); and multiplexing radio resources by utilizing limited radio resources ('942 Patent at 1:56-67).

e) Background and State of the Art Related to the '460 Patent

The following section describes the background and state of the art related to the '460 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '460 patent's earliest alleged priority date. The interpretation of the features of the '460 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS) and method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE), the method comprising. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for elements 1[pre] and 5[pre], for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE and transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for elements 1[a] and 5[a], for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set and transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for elements 1[b] and 5[b], for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information and receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for elements 1[c] and 5[c], for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for elements 1[d], 5[d], 9[c] for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI). *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for elements 1[e], 5[e], 9[d], for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for claims 2, 6, and 10 for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a number of frequency hopping offset values included in the frequency

hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for claims 3, 7, and 11 for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for claims 4, 8, and 12 for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS), the UE comprising. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for element 9[pre] for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for element 9[a] for example.

Prior to the '460 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information. *See, e.g.*, TS 38.213, TS 38.214, Dahlman, Mehari, TS 36.213, Takeda, Ouchi, Shen, Matsumura, Zhang, R1-1801080, and Yin; including the portions identified in E-1–E-12 and Appendix E for element 9[b] for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for frequency hopping ('460 patent at 1:1-58); uplink and downlink transmission ('460 patent at 4:19-24); physical channels like the Physical Downlink Control Channel, Physical Downlink Control Channel, Physical Downlink Shared Channel, and Physical Uplink Shared Channel ('460 patent at 4:28-34); radio resource control (RRC) signaling ('460 patent at 4:48-50); user equipment and base station ('460 patent at 3:38-57); resource allocation ('460 patent at 5:1-7); machine-type communication (MTC) ('460 patent at 5:8-26); New Radio (NR) ('460 patent at 5:49-62); time-division multiplexing (TDM) and frequency-division multiplexing (FDM) ('460 patent at 6:7-25); configuring bandwidth parts (BWPs) ('460 patent at 7:7-15); uplink control information (UCI) ('460 patent at 7:29-31).

f) Background and State of the Art Related to the '118 Patent

The following section describes the background and state of the art related to the '118 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '118 patent's earliest alleged priority date. The interpretation of the features of the '118 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a method of a user equipment for configuring dual connectivity, a method of a secondary base station for controlling dual connectivity of a user equipment, and a user equipment for configuring dual connectivity. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for elements 1[pre], 7[pre], and 10[pre], for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of adding and configuring a secondary base station signaling radio bearer, determining, by the secondary base station, to add a secondary base station signaling radio bearer to the user equipment, and a controller configured to add and configure a secondary base station signaling radio bearer. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for elements 1[a], 7[a], and 10[a], for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB, transmitting a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group to the user equipment through the secondary base station SRB, and a receiver configured to receive from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB. *See, e.g.*, Yang, Zhang, Takahashi,

R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for elements 1[b], 7[b], and 10[b], for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station, and a transmitter configured to transmit a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for element 1[c], claim 9, and element 10[c], for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the addition of the secondary base station SRB is determined by the secondary base station, the user equipment configures dual connectivity by using a master base station and the secondary base station, and the addition of the secondary base station SRB is determined by the secondary base station. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for elements 1[d], 7[d], and 10[d], for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the master base station and the second base station are base stations

using radio access technologies different from each other. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for claims 2, 8, and 11, for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for claims 3 and 12, for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for elements 4 and 13, for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the radio resource on the secondary base station or the secondary cell group includes at least one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for claims 5 and 14, for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the failure information message includes cause information on the secondary base station radio resource configuration failure. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for claims 6 and 15, for example.

Prior to the '118 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station. *See, e.g.*, Yang, Zhang, Takahashi, R2-141109, Wu, Heo, Velde, Sharma, Parkvall, R2-133392, R2-140059, R2-144867; Futaki; including the portions identified in F-1–F-13 and Appendix F for elements 7[c], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for transmitting and receiving data ('118 patent at 1:32-38); dual connectivity ('118 patent at 1:55-67, 7:53-62); adding a secondary base station ('118 patent at 6:60-7:63); a master base station requesting a secondary base station to allocate radio resources ('118 patent at 6:63-7:7); transmitting RRC reconfiguration messages ('118 patent at 7:18-22); user equipment applying RRC reconfiguration and sending response message ('118 patent at 7:23-28).

g) Background and State of the Art Related to the '000 Patent

The following section describes the background and state of the art related to the '000 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '000 patent's earliest alleged priority date. The

interpretation of the features of the '000 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of methods of transmitting/receiving uplink (UL) control information by a user equipment/by a base station, respectively, and user equipment for transmitting, uplink (UL) control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Oh, Zhang, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[pre], 5[pre], and 9[pre], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving/transmitting, from the base station/to the user equipment, respectively, and a receiver configured to receive from the base station, UL control channel resource set configuration information for UL control information transmission. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[a], 5[a], and 9[a], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of determining, and a controller configured to determine, one of UL control channel resource sets contained in the received UL control channel resource set configuration information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[b], 5[b], and 9[b], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of determining, and a controller configured to determine, one of UL control

channel resources contained in the determined UL control channel resource set. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[c], 5[b], and 9[b], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting/receiving, by the user equipment/by the base station, respectively, and a transmitter configured to transmit, UL control information through the determined UL control channel resource. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[d], 5[b], and 9[c], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[e], 5[c], and 9[d], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 1[f], 5[d], and 9[e], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the UE. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in G-1–G-16 and Appendix G for elements 2, 6, and 10, for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that each UL BWP is activated through downlink (DL) control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079, R1-1711853; including the portions identified in G-1–G-16 and Appendix G for elements 3, 7, and 11, for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving/transmitting, from the base station/to the user equipment, respectively, and a receiver for receiving, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079, R1-1711853; including the portions identified in G-1–G-16 and Appendix G for elements 4[a], 8[a], and 12[a], for example.

Prior to the '000 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the one of the UL control channel resources is indicated from the base station/to the user equipment through the DL control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-

1713181, R1-1714079, R1-1711853; including the portions identified in G-1–G-16 and Appendix G for elements 1[f], 5[d], and 9[e], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation, that "certain (RRC) information can be signaled to set or configure BWPs" ('000 FH, 06-21-2021 Response to Office Action at 9); a "PUCCH is an UL control channel for the transmission of uplink control information (UCI) by a UE" ('000 patent at 7:41-44); different types of flexible frame structures in new radio (NR) provide for various usage scenarios ('000 patent at 1:45-51, 5:59-67); supporting scalable bandwidth operation for a component carrier (CC) ('000 patent at 7:1-2); UEs having different transmission/reception bandwidth capability from another in one broadband NR CC ('000 patent at 7:9-11); methods for determining a set of UL control channel resources out of a plurality of sets of UL control channel resources, selecting an uplink channel resource from the set of uplink control channel resources, transmitting, by the user device, control information via the selected uplink control channel resource ('000 FH, 06-21-2021 Response to Office Action at 9, Fig. 5); that "NR defines different PUCCH formats according to payload sizes of uplink control information" ('000 patent at 8:8-10); that "a plurality of BWPs, BWP transitions, and RRC signals [may be] used to set or transition states for BWPs" ('000 FH, 06-21-2021 Response to Office Action at 8); and that "NR rel-15 defines that only one DL BWP and one UL BWP are activated and used in an UE at any time" ('000 patent at 7:37-39).

h) Background and State of the Art Related to the '463 Patent

The following section describes the background and state of the art related to the '463 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '463 patent's earliest alleged priority date. The

interpretation of the features of the '463 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of methods of transmitting/receiving uplink (UL) control information by a user equipment/by a base station, respectively, and user equipment for transmitting, uplink (UL) control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in H-1–H-16 and Appendix H for elements 1[pre], 4[pre], and 7[pre], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving/transmitting, from a base station/to a user equipment, respectively, and a receiver configured to receive from the base station, UL control channel resource set configuration information for UL control information transmission. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in H-1–H-16 and Appendix H for elements 1[a], 4[a], and 7[a], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of determining, and a controller configured to determine, one of UL control channel resource sets contained in the UL control channel resource set configuration information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in H-1–H-16 and Appendix H for elements 1[b], 4[b], and 7[b], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of determining, and a controller configured to determine, one of UL control

channel resources contained in the determined UL control channel resource set. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in H-1–H-16 and Appendix H for elements 1[c], 4[b], and 7[b], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of transmitting/receiving, by the user equipment/by the base station, respectively, and a transmitter configured to transmit, UL control information through the determined UL control channel resource. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in H-1–H-16 and Appendix H for elements 1[d], 4[b], and 7[c], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079; including the portions identified in H-1–H-16 and Appendix H for elements 1[e], 4[c], and 7[d], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that each UL BWP is activated through downlink (DL) control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079, R1-1711853; including the portions identified in H-1–H-16 and Appendix H for elements 1[f], 4[d], and 7[e], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079, R1-1711853; including the portions identified in H-1–H-16 and Appendix H for elements 2, 5, and 8, for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of receiving/transmitting, from the base station/to the user equipment, respectively, and a receiver for receiving, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079, R1-1711853; including the portions identified in H-1–H-16 and Appendix H for elements 3[a], 6[a], and 9[a], for example.

Prior to the '463 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware that the one of the UL control channel resources is indicated from the base station through the DL control information. *See, e.g.*, Ahn, LI, Marinier, Nayeb Nazar, Shaheen, Takeda I, Takeda II, Takeda III, Yan, Yang, Zhang, Oh, R1-1709802, R1-1713181, R1-1714079, R1-1711853; including the portions identified in H-1–H-16 and Appendix H for elements 3[b], 6[b], and 9[b], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art including, without limitation, various types of measurement configurations for BWPs and cells ('463 FH, 12-02-2019 Response to Office Action at 6); flexible frame structures in new radio (NR) for various

usage scenarios (’463 patent at 1:26-30, 1:35-41, 5:30-34, 5:52-57); scalable bandwidth operation for a component carrier (CC) (’463 patent at 6:57-63); UEs having different transmission/reception bandwidth capability from another in one broadband NR CC (’463 patent at 6:64-66); a “PUCCH is an UL control channel for the transmission of uplink control information (UCI) by a UE” (’463 patent at 7:29-32); “NR defines different PUCCH formats according to payload sizes of uplink control information” (’463 patent at 7:63-66); types of BWPs for a UE device (’463 FH, 12-02-2019 Response to Office Action at 6); BWP transitions including transitioning from an initial BWP to an active BWP (’463 FH, 12-02-2019 Response to Office Action at 6); “NR rel-15 defines that only one DL BWP and one UL BWP are activated and used in an UE at any time” (’463 patent at 7:25-27); and RRC signaling (’463 FH, 12-02-2019 Response to Office Action at 6).

i) Background and State of the Art Related to the ’272 Patent

The following section describes the background and state of the art related to the ’272 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the ’272 patent’s earliest alleged priority date. The interpretation of the features of the ’272 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the ’272 patent’s earliest alleged priority date, a person of ordinary skill in the art would have been aware of base stations and wireless devices comprising a transceiver, receiver, and controller. *See, e.g.*, Lee ’325, You, Lee ’434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[pre], 8[pre-c], and 15[pre], for example.

Prior to the ’272 patent’s earliest alleged priority date, a person of ordinary skill in the art would have been aware of a base station transmitting and the wireless device receiving a radio resource control (RRC) signal including information on one or more allocations of a time-domain

resource that includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[a], 8[d], 8[e], 15[a] and 15[b], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of wherein, based on the information, a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH). *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[b], 8[f], and 15[c], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a determined number of OFDM symbols that is smaller than or equal to a number of OFDM symbols included in a slot. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[c], 8[g], and 15[d], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a base station transmitting and a wireless device receiving downlink control information (DCI), including a field including a bit string. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[d], 8[i], and 15[e], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a bit string in the field that relates to a row index of an allocation table. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[e], 8[j], and 15[f], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of allocation tables that include information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 1[f], 8[k], and 15[g], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the aforementioned bit strings wherein the bit string length is 3 bits in length. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 2[a], 9[a], and 16[a], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of DCI information that further includes information on one or more allocations of a frequency-domain resource. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 3[a], 10[a], and 17[a], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of base stations and wireless devices that support new radio access technology (NR). *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 4[a], 11[a], and 18[a], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of base stations and wireless devices that support different numerologies which are defined by subcarrier spacing (SCS). *See, e.g.*, Lee '325, You, Lee '434, Cheng,

Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 5[a], 12[a], and 19[a], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the base station transmitting and the wireless device receiving downlink data via the PDSCH. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 6[a], 13[a], and 20[a], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of the base station transmitting and the wireless device receiving uplink data via the PUSCH. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 6[b], 13[b], and 20[b], for example.

Prior to the '272 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of using a maximum of 14 OFDM symbols. *See, e.g.*, Lee '325, You, Lee '434, Cheng, Papasakelleriou, and Park; including the portions identified in I-1 – I-7 and Appendix I for elements 7[a] and 14[a], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for deploying enhanced mobile broadband (eMBB), massive machine-type communication (mMTC), and ultra reliable and low latency communication (URLLC) ('272 Patent at 1:29-41); using flexible frame structures ('272 Patent at 44-45); allocating uplink/downlink data resources that have been performed on a resource block (RB) basis in the frequency axis and on a subframe basis in the time axis ('272 Patent at 46-

49); using OFDM symbols to receive downlink data ('272 Patent at 1:50-55); and allocating a time-domain resource as well as a frequency resource as a scheduling resource for an uplink/downlink data channel ('272 Patent at 1:56-59).

j) Background and State of the Art Related to the '644 Patent

The following section describes the background and state of the art related to the '644 paten, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '644 patent's earliest alleged priority date. The interpretation of the features of the '644 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[pre], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[pre], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, the terminal comprising a receiver configured to receive configuration information. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[a], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, the terminal comprising a receiver configured to receive configuration information comprising information on a start subframe of the plurality of subframes. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[a], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, the terminal comprising a receiver configured to receive configuration information through higher layer signaling. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[a], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, the terminal comprising a receiver configured to receive the downlink control channels repeatedly allocated in the plurality of subframes. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[a], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, the terminal comprising a receiver configured to combine the received downlink control channels based on the configuration information. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825,

Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[a], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, the terminal comprising a controller configured to extract downlink control information from the combined downlink control channels. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[b], for example.

Prior to the '644 patent's earliest alleged priority date, a person of ordinary skill in the art would have been aware of a terminal for receiving downlink control channels, wherein the downlink control information comprises information on the number of the plurality of subframes. *See, e.g.*, Zhuang, Yang-084, Baker, Vajapeyam, Lee-668, Lee-825, Papasakellariou-915; You-420; including the portions identified in J-1–J-8 and Appendix J for element 3[c], for example.

In addition to the foregoing concepts, features, and technologies, the patents and file histories acknowledge that other features and technologies were known in the prior art, including without limitation that various methods were known in the art for Machine Type Communication (MTC) ('644 patent at 1:26-29, 6:65-7:1); various types of communication services, such as voice, packet data, and the like ('644 patent at 3:46-49); transceiving data to/from a Base Station by the User Equipment ('644 patent at 4:10-12); transceiving data to/from the User Equipment by the Base Station ('644 patent at 4:12-14); transmitting control information through control channels, such as a Physical Downlink Control CHannel (PDCCH), an Enhanced PDCCH (EPDCCH), a Physical Control Format Indicator CHannel (PDFICH), a Physical Hybrid ARQ Indicator CHannel (PHICH), a Physical Uplink Control CHannel (PUCCH), and the like ('644 patent at 4:38-46,

5:13-16); transmitting data on data channels, such as a Physical Downlink Shared Channel, a Physical Uplink Shared CHannel, and the like ('644 patent at 4:46-49); downlink transmission ('644 patent at 5:17-41); blind decoding of Control Channel Element (CCE) or Enhanced CCE (ECCE) ('644 patent at 6:10-20, 6:38-55); and repeatedly transmitting, to a plurality of subframes, downlink control information (DCI), soft-combining with regard to the same DCI, and decoding the transmitted DCI ('644 patent at 8:14-17).

k) Background and State of the Art Related to the '161 Patent

The following section describes the background and state of the art related to the '161 patent, including descriptions of many features of the patent that would have been known to a person of ordinary skill in the art prior to the '161 patent's earliest alleged priority date. The interpretation of the features of the '161 patent applied in this section is based on the apparent interpretation used by Pegasus in its infringement contentions.

At the time of the alleged invention of the '161 Patent, a person of ordinary skill in the art would have been aware of the impending exponential growth in mobile data traffic expected to occur over the next few years. *See* Mu at 1 ("Due to the diversity of smart phones, video service and high-speed data access, the mobile data traffic is expected to grow beyond 1000 times by 2020 compared with it in 2010."). A person of ordinary skill in the art would also have been aware of the increased emphasis on small cell networks in LTE-Advanced, and the greater signal to interference plus noise ratio (SINR) that could result from this small cell deployment. *See* Mu at 1 (describing a "prioritized scenario for small cell enhancement" in LTE-Advanced), 2 ("high SNR performance could be expected"); Qualcomm 451 at 1 ("With the densification of small cells and advances in implementation, it is possible for the UE to achieve high SNR operation conditions, motivating the need to investigate possible benefits that could be offered by high modulation order transmissions, particularly, 256QAM."); Hammarwall at [0037] ("Typically, the additional

MCS/CQI tables are used in scenarios with high Signal-to-Noie Ratio, SNR, or SINR which allow for higher-order modulation to be used thanks to the high signal quality.")

A person of ordinary skill in the art would also have understood the importance of improving spectral efficiency in order to support the increased traffic, and the role that 256 QAM could play in supporting greater spectral efficiency. *See* Mu at 1 ("In this case, introducing a high-order-modulation such as 256 QAM is a possible way to reach high spectrum efficiency and peak data rate in downlink transmission."); ZTE 258 at 1 ("Spectrum efficiency enhancement with introduction of higher order modulation, i.e., 256QAM, in the downlink transmission, while keeping existing size of CQI feedback field . . . ."); Alcatel 160 at 1 (same); Ericsson 753 (same). For example, because the peak spectral efficiency reached by a 256QAM CQI index table could reach approximately 7.4 bit/s/Hz, "it is necessary to introduce new CQI/MCS/TBS tables to support 256QAM." Huawei 033 at 1; FiberHome 366 at 2 ("the maximum spectral efficiency with 256 QAM can be 5.5547x8/6 = 7.4063"); Qualcomm 451 at 2 (same); ZTE 258 at 2 ("To fully exploit the efficiency, the maximum code rate for 256 QAM can be up to 0.93, corresponding to a SNR of about 25.5 dB."); Huawei 034 at 2 ("Since the maximum efficiency supported by current CQI table is 5.5547, the introduction of 256QAM can directly increase the efficiency to 5.5547×8/6 = 7.4063."). Thus, a person of ordinary skill in the art would have understood the importance of designing a 256 QAM CQI table to support the introduction of higher order modulation. *See, e.g.*, Mu at 1; Alcatel 058 at 1 ("One proposal for increasing the peak data rates in small cells is to introduce a higher order modulation scheme (e.g. 256 QAM)."); Hammarwall at [0036] ("In order to support higher-order modulation, i.e. higher than the above schemes . . . UEs must support an additional MCS/CQI table that also includes specific entries for new

modulation schemes."), [0038] ("it may be desirable to use higher-order modulation, e.g. 256QAM, to increase the data rate when the signal quality allows").

A person of ordinary skill in the art prior to the time of the purported invention of the '161 Patent would have been aware of methods of designing a CQI index table such that the CQI index values are separated by equal SINR spacing. *See, e.g.*, Huawei 033 at 1 ("The sampling is based on equal SINR spacing principle . . . ."); FiberHome 366 at 1 ("[F]or the new CQI table, it seems reasonable to follow the previous principle, the 256QAM MCSs could be introduced with the same SNR step size of 1.892dB."), 2 ("Proposal 1: Current CQI entries #2, #4 and #6 should be removed to down-sample low CQI entries and add three new entries for 256QAM."); ZTE 258 at 2 ("Spectral efficiencies in CQI table are chosen such that mapping between CQI indices and SNR (e.g. targeting at 10% BLER) is even."); Broadcom 609 at 2 ("The CQI granularity, i.e. SNR increment between adjacent CQIs, affects the link adaptation and throughput of the system. For that reason, and for other practice reasons . . . we propose that the same CQI granularity is kept for 256 QAM."); Ericsson 753 at 2 ("Three new CQI values are introduced to cover equal SNR spacing of 2.5dB between Rel-8 CQI 14 rate and the highest 256QAM rate at spectral efficiency of 8*0.928."); Nokia 529 at 2 ("In order to have roughly 2dB granularity, it is good to define two more 256QAM CQIs (2nd and 3rd 256QAM CQI), with the gap being roughly 5.66/3=1.88dB."); Larsson 091 at 9:29-35 ("In particular embodiments, in the high SNR region, the entries for 256QAM may be obtained by sampling with equal spacing."), 7:67-8:4 ("Three new CQI values cover equal SNR spacing between the Rel-8 CQI entry 14 rate and the highest 256QAM rate at 8*0.928."), FIG. 5. Specifically, a person of ordinary skill in the art would have been aware that the design principles used to design the existing 64QAM CQI index table included using "approximately equal step size in equivalent SNR" and assuming an AWGN channel. Huawei 034

at 1. A person of ordinary skill in the art would have understood that the same design principles could be applied to the design of the 256QAM index table. *See, e.g.*, Huawei 034 at 2 ("***Following the previous principle***, the CQI entries for 256QAM could be determined using an equal step size in equivalent SNR between 5.5547 and 7.4063.") (all emphases added).

A person of ordinary skill in the art prior to the time of the purported invention of the '161 Patent would have understood that one way of designing a new 256QAM CQI index table could involve removing certain existing indexes in the current 64QAM CQI index table and replacing them with new CQI index values for 256QAM modulation so that the existing size of the CQI feedback field is maintained. *See, e.g.*, Huawei 033 at 2 ("Several new items for 256QAM should be incorporated and some of the existing indexes in current table should be dropped, while ensuring some low-SINR items are still kept."); FiberHome 366 at 1 ("Down-sample low CQI entries by removing Y1 entries, and add Y1 new entries for 256QAM region with even spacing"); Qualcomm 451 at 2 ("To support 256QAM with a 4-bit CQI table, some of existing entries have to be removed and some 256QAM entries have to be added."); Ericsson 753 at 1 ("At RAN #62, it was agreed that the size of CQI feedback field should be kept, which affords the advantage of retaining the number of bits in the UCI formats and hence minimizes the standard impacts."); Huawei 1120 ("In the RAN1#76 meeting, the principles of 256QAM CQI/MCS tables were agreed as: . . . Down-sample low CQI entries by removing Y1 entries, and add Y1 new entries for 256QAM region with even spacing.").

Relatedly, a person of ordinary skill in the art prior to the time of the purported invention of the '161 Patent would have been aware of numerous ways to test the design of proposed 256QAM CQI index tables using computer simulations. *See, e.g.*, Mu at 2 (plotting the SINR and spectral efficiency of several modulation orders), 4; Ding 2011 at 3 ("A MATLAB platform is

provided in [10] with basic system level simulation modeling using commonly accepted models."); Alcatel 058 at 1 ("To evaluate the BLER and throughput performance of 256 QAM with different code rates, as well as to find out the impact of EVM, we assume table 1 as the CQI table in the link level simulations," the results of which "are based on SISO and AWGN channel"), 2 (Figure 1), 3-7 (describing link level simulation with EVM); ZTE 258 at 3 ("Figure 3 shows that the mapping between CQI indices and SNR (e.g. targeting at 10% BLER) is even."), 8 (Appendix A); Hitachi 521 at 3 ("In order toe verify the impact to the system throughput results, we simulated the system using the new table-switching mechanism based on CQI tables/MCS tables described in section 2.1."); Ericsson 753 at 3-4 (describing simulation results such as the "achievable spectral efficiency for different MCS with 10% BLUER target . . . for both AWGN channel and the EVA channel"); ZTE 136 at 1-4 (describing system-level simulation evaluating gain after introduction of 256QAM based on certain simulation assumptions and mapping CQI against SNR); Huawei 034 at 4 (Figs. 3, 4) (describing 64QAM/256QAM BLER comparison of the same spectral efficiency in the EPA channel with rank 1 resulting from link level simulations); Huawei 120 at 7-9 (describing simulation results); Nokia 529 at 1 ("Based on these agreements, we provide simulation results on determining the number of new 256QAM CQIs and defining reasonable code rate for each new CQI entry and provide our suggestion for the 256QAM CQI table fulfilling the CQI table design principles agreed in RAN1#76."), 2 (depicting SNR-BLER curves for various code rates); Chen 2011 at 1-2 ("Most of the previous works utilize the SNR-CQI mapping to determine CQIs.").

For example, prior to the time of the purported inventions of the '161 Patent, a person of ordinary skill in the art would have been aware that simulations performed on the physical layer (link-level) are required for research and develop aspects of LTE. *See* Ikuno 2010 at 1; *see also*

Mehlfuhrer 2009 at 1 ("Research and development of signal processing algorithms for UMTS Long Term Evolution (LTE) requires a realistic, flexible, and standard-compliant simulation environment."); Mehlfuhrer 2011 at 1 (describing need for reproducibility in signal processing research and the potential solution of the Vienna LTE link- and system-level simulators); Chen 2011 at 3 ("In our work, we employ a link-level simulation platform . . . ."). A person of ordinary skill would have been aware of several commercially-available simulators, simulators developed by universities, and would have been aware of the existence of "proprietary simulators" developed by telecommunications providers. Mehlfuhrer 2009 at 1. One such example is the free, open-source, MATLAB-based downlink physical-layer simulator for LTE developed by Mehlfuhrer et al. that could be used to model block error ratio (BLER) curves, known as the Vienna LTE Link Level Simulator. *See* Mehlfuhrer 2009 at FIG. 5 (showing BLER curves obtained from SISO AWGN simulations for 15 CQI values); *see generally* Kitanov (describing Vienna LTE Link Level Simulator). A person of ordinary skill in the art would have understood that "[i]n LTE, adaptive modulation and coding has to ensure a BLER value smaller than 10%," and "[t]he SINR-to-CQI mapping required to achieve this goal can thus be obtained by plotting the 10% BLER values of the curves in Figure 5 over SNR." Mehlfuhrer 2009 at 5; *see also* Kitanov at 7 ("To obtain the Block Error Ratio (BLER) and throughput for the [MCS] corresponding to each CQI value, AQGN simulations were performed."), FIG. 3. Then, "[u]sing the obtained line, an effective SINR can be mapped to a CQI value that is signalled to the eNodeB." Mehlfuhrer 2009; Chen 2011 at 2 (describing SNR-CQI mapping).

Prior to the alleged invention of the '161 Patent, a person of ordinary skill in the art would have been aware of methods for transmitting channel state information by a User Equipment (UE). For example, TS 36.213 explains that "[t]he time and frequency resources that can be used by the

UE to report CSI which consists of Channel Quality Indicator (CQI), precoding matrix indicator (PMI), precoding type indicator (PTO), and/or rank indication (RI) are controlled by the eNB." TS 36.213 at 55; *see also* LTE Book at 652 ("[I]n order to enable the UE to estimate and feed back the Channel State Information (CSI) corresponding to up to eight antenna ports across a wide bandwidth, new RSs referred to as CSI-RS are provided."); Xia 681 at 47 ("In the LTE (Long Term Evolution) system, the adaptive process of the Physical Downlink Shared Channel (PDSCH) is: User equipment (UE, User Equipment) estimates channel state information. (CSI, Channel State Information) channel information . . . ."), 92 ("First, the user equipment (UE, User Equipment) estimates channel information for measuring channel state information (CSI)."); Kim 201 at [0134] ("[A] UE feeds back CSI using containers of PUCCH format 2 at intervals of 5 ms. According to CSI configuration information of FIG. 11, CSI is fed back in such a manner that an RI is transmitted in the first container and a PMI and CQI are transmitted in the second to fourth containers."); Wang 773 at [0002] ("In 3GPP (3rd Generation Partnership Project) Rel. 8/9/10 system, Channel Quality Indicator (CQI), one type of channel state information (CSI), is an important communication parameter used for scheduling and link adaptation at eNodeB (eNB)."); Xu 784 at cl. 5 ("the base station receiving channel state information of the UE, wherein the channel state information at least comprises channel quality indication (CQI) information . . . ."); Hammarwall at [0035] ("In the uplink, the UE reports CQI to assist the serving radio node to select the appropriate MCS to apply for downlink transmissions."), including the portions identified in K-1 through K-8 and Appendix K for elements 1[pre], 3[pre], and 5[pre], for example.

A person of ordinary skill in the art prior to the alleged invention of the '161 Patent would have been aware that a UE could receive a reference signal for measuring channel quality from a base station. Relatedly, a person of ordinary skill in the art would have been aware of methods for

UEs to measure channel quality based on the reference signal. For example, in addition to the four types of reference signals already present in LTE downlink, Release 10 introduced the concept of channel state information (CSI) reference signals "specifically for the purpose of estimating the downlink channel state and not for data demodulation." LTE Book at 165; *see also id*. at 654-657. A person of ordinary skill in the art would have been aware that "[i]n LTE, the UE can be configured to report CQIs to assist the eNodeB in selecting an appropriate MCS to use for the downlink transmission." LTE Book at 217. "The CQI reports are derived from the downlink received signal quality, typically based on measurements of the downlink reference signals." LTE Book at 217; Xia 681 at 47 ("In the LTE (Long Term Evolution) system, the adaptive process of the Physical Downlink Shared Channel (PDSCH) is: User equipment (UE, User Equipment) estimates channel state information. (CSI, Channel State Information) channel information . . . the UE obtains the CQI value according to the channel quality indicator (CQI, Channel Quality Indicator) according to the SINR."); Enescu 845 at 7:54-59 ("In an embodiment, this can be realized by receiving from the eNodeB a reference signal configuration and a feedback mode, information on which reference signals should be used for channel estimation (and hence CQI feedback) and the type of CSI feedback . . . ."); Kim 201 at FIG. 18, [0164] ("Then, the UE measures a first channel state value to which the muting point is not applied and a second channel state to which the muting point is applied using the first and second reference signals received according to the first and second CSI configuration information (S185)."), cl. 6; Wang 773 at [0002] ("In practice, since UE (user equipment) knows better about the downlink channel based on certain reference signal . . . CQI is calculated and recommended at UE side."); Hammarwall at [0035] ("Typically, the CQIs are derived from measurements made by the UE on downlink

reference signals transmitted by the serving radio node."), including the portions identified in K-1 through K-8 and Appendix K for elements 1[a], 3[a], 3[b], 3[c], and 5[a], for example.

Prior to the alleged invention of the '161 Patent, a person of ordinary skill in the art would have been aware of methods of selecting a channel quality indicator (CQI) index value from a predetermined CQI index table. For example, TS 36.213 describes that "[t]he time and frequency resources that can be used by the UE to report CSI which consists of Channel Quality Indicator (CQI), precoding matrix indicator (PMI), precoding type indicator (PTI), and/or rank indication (RI) are controlled by the eNB." TS 36.213 at 55; *see also id*. at 81-85 (defining CQI); Mu at 3 ("UEs feed back the effective SINR by conveying the CQI index with 4 bits."). The CQI index value is selected from a predetermined CQI index table (4-bit CQI Table) of TS 36.213. *See also* LTE Book at 218 ("The list of modulation schemes and code rates which can be signalled by means of a CQI value is shown in Table 10.1."); Xia 681 at 47 ("the CQI value and the network condition reported by the UE"); Xia 681 at 92 ("Specifically, the UE determines the first spectrum efficiency according to the measured first SINR, and then obtains the first CQI number corresponding to the first spectrum efficiency according to the first spectrum efficiency and the first CQI table. The first CQI table is pre-stored by the UE."); Kwon 630 at [056] ("The CQI is configured to determine and send to the eNB 102 an index value (i.e., CQI value) indicating a quality of the first channel."); Kim 201 at cl. 6 ("respectively measuring a first channel state value and a second channel state value on the basis of the first reference signal and the second reference signal; calculating a channel quality index (CQI) on the basis of one selected between the first channel state value and the second channel state value . . . ."); Wang 773 at [0002] ("In practice, since UE (user equipment) knows better about the downlink channel based on certain reference signal . . . CQI is calculated and recommended at UE side" and "is feedback [sic] by the UE with a certain index in the CQI

table . . . referring to Table 7.2.3-1 in 3GPP TS 36.213 V10.5.0 . . . ."); Hammarwall at [0035] ("The CQI is signaled from the UE to the radio node with reference to a redefined CQI index table . . . ."); Xia 244 at [0003] ("the UE quantizes the SINR obtained by calculation into a 4-bit channel quality indicator (CQI)"), including the portions identified in K-1 through K-8 and Appendix K for elements 1[b], 3[c], and 5[b], for example.

Prior to the alleged invention of the '161 Patent, a person of ordinary skill in the art would have been aware of predetermined CQI index tables including CQI index values for 256 quadrature amplitude modulation (QAM) modulation. *See* Mu at 4 (Table IV); Huawei 033 at 4 (Table 1); Alcatel 058 at 1-2 (Table 1); FiberHome 366 at 2 (Table 1); Qualcomm 451 at 2 (Table 2); ZTE 258 at 3 (Table 1); Alcatel 160 at 4 (Table 3); Hitachi 521 at 2 (Table 2); Broadcom 609 at 1-2 (Table 3(b)); Ericsson 753 at 102 (Table 1(b)); ZTE 136 at 3-4 (Table 2); Huawei 034 at 4 (Table 1); Nokia 529 at 2 (Table 1); Larsson 091 at FIG. 4; Xu 784 at Table 3; Olsson at Table 4; Xia 681 at Table 6-3, including the portions identified in K-1 through K-8 and Appendix K for elements 1[b], 3[c], and 5[b], for example.

More specifically, a person of ordinary skill in the art prior to the alleged invention of the '161 Patent would have been aware of a CQI index table containing 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. *See, e.g.*, Huawei 033 at 4 (Table 1); FiberHome 366 at 2 (Table 1); Nokia 529 at 2 (Table 1); Kwon 630 at [0041], Table 5; Xia 244 at Table 2; Xia 681 at Table 6-3, including the portions identified in K-1 through K-8 and Appendix K for elements 1[d], 3[d], and 5[d], for example.

Prior to the alleged invention of the '161 Patent, a person of ordinary skill in the art would have been aware that the code rate value of one of the four CQI index values for 256QAM

modulation could be calculated to be 711 using "code rate x 1024." *See, e.g.*, Huawei 033 at 4 (Table 1); FiberHome 366 at 2 (Table 1); Nokia 529 at 1 ("It is observed that code rate of 711/1024 is a good candidate, under which 256QAM has marginal performance difference from CQI15, implying that the performance gap between current CQI14 and 1st 256QAM CQI remains mostly unchanged."); Nokia 529 at 2 (Table 1); Kwon 630 at [0041], Table 5; Xia 244 at Table 2; Xia 681 at Table 6-3, including the portions identified in K-1 through K-8 and Appendix K for elements 1[g], 3[g], and 5[g], for example.

A person of ordinary skill in the art prior to the alleged invention of the '161 Patent would have been aware that one of the four CQI index values for 256QAM modulation could be 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. At the time of the purported invention of the '161 Patent, the 64QAM CQI index table described in TS 36.213 contained a maximum efficiency of 5.5547. *See* TS 36.213 at Table 7.2.3-1; LTE Book at 219 (Table 10.1); Mu at 2 (Table 1); FiberHome 366 at 2 ("the maximum efficiency supported by current CQI table is 5.5547"). A person of ordinary skill in the art would have been aware of several 256QAM index tables that include a CQI index value having a transmission efficiency of 5.5547. *See, e.g.*, Huawei 033 at 4 (Table 1); FiberHome 366 at 2 (Table 1); Huawei 034 at 4 (Table 1); Huawei 120 at 5 ("The SE (5.5547 should be maintained to reduce impact on Modulation and TBS index/TBS tables," and "[t]he modulation order of existing CQI index 15 is changed to 256QAM."); Nokia 529 at 2 (Table 1); Kwon 630 at [0041], Table 5; Xia 244 at Table 2; Xia 681 at Table 6-3, including the portions identified in K-1 through K-8 and Appendix K for elements 1[e], 3[e], and 5[e], for example.

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

TS 36.213 at Table 7.2.3-1.

A person of ordinary skill in the art prior to the alleged invention of the '161 Patent would have been aware that another of the four CQI index values for 256QAM modulation could be configured to have another code rate value that is the same as the code rate value having a maximum transmission efficiency of a CQI index table that excludes CQI index values for 256QAM modulation. At the time of the purported invention of the '161 Patent, the 64QAM CQI index table described in TS 36.213 contained a maximum efficiency of 5.5547. *See* TS 36.213 at Table 7.2.3-1; LTE Book at 219 (Table 10.1); Mu at 2 (Table 1). The code rate associated with the maximum efficiency of 5.5547 in the 64QAM CQI index table is 948/1024. *See id*. In other words, prior to the alleged invention of the '161 Patent, a person of ordinary skill in the art would have been aware that another code rate value of another of the four CQI index values for 256QAM modulation could be calculated to be 948 using "code rate x 1024." *See* Mu at 4 (Table IV); FiberHome 366 at 2 (Table 1); Qualcomm 451 at 2 (Table 2); Alcatel 160 at 4 (Table 3); Hitachi 521 at 2 (Table 2); Huawei 034 at 4 (Table 1); Nokia 529 at 2 (Table 1); Chen 732 at FIG. 4;

Olsson at Table 4; Xia 681 at Table 6-3, including the portions identified in K-1 through K-8 and Appendix K for elements 1[f], 1[i], 3[f], 3[i], 5[f], and 5[i], for example.

Finally, a person of ordinary skill in the art prior to the alleged invention of the '161 Patent would have been aware of methods for transmitting channel state information including the selected CQI index value to the base station. For example, TS 36.213 explains that "[t]he time and frequency resources that can be used by the UE to report CSI which consists of Channel Quality Indicator (CQI), precoding matrix indicator (PMI), precoding type indicator (PTO), and/or rank indication (RI) are controlled by the eNB." TS 36.213 at 55; *see also* LTE Book at 662-665 (describing enhanced CSI feedback); Xia 681 at 92 ("report the CQI value to the base station"); Enescu 845 at 7:54-59 ("In an embodiment, this can be realized by receiving from the eNodeB a reference signal configuration and a feedback mode, information on which reference signals should be used for channel estimation (and hence CQI feedback) and the type of CSI feedback . . . ."); Kim 201 at [0134] ("[A] UE feeds back CSI using containers of PUCCH format 2 at intervals of 5 ms. According to CSI configuration information of FIG. 11, CSI is fed back in such a manner that an RI is transmitted in the first container and a PMI and CQI are transmitted in the second to fourth containers."); Kim 201 at cl. 6 ("transmitting the CQO and a selection index including information on the selection"); Xu 784 at cl. 5 ("the base station receiving channel state information of the UE, wherein the channel state information at least comprises channel quality indication (CQI) information . . . ."); Xia 422 at [0003] ("the UE reports values of the PMI, the RI, and the CQI to an evolved NodeB (eNB)."), including the portions identified in K-1 through K-8 and Appendix K for elements 1[g], 3[g], and 5[g], for example.

2. Motivation to Combine

Each prior art reference may be combined with one or more other prior art references to render obvious the Asserted Claims in combination, as explained in more detail below. The

disclosures of these references also may be combined with information known to persons skilled in the art at the time of the alleged invention, and understood and supplemented in view of the common sense of persons skilled in the art at the time of the alleged invention, including any statements in the intrinsic record of the Asserted Patents and related applications.

A person of ordinary skill would have been motivated to combine the prior art cited in the attached claim charts based on the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. The identified prior art references, including portions cited in the claim charts, address the same or similar technical issues and suggest the same or similar solutions to those issues as the Asserted Claims. On such bases, on an element-by-element basis, Defendants intend to combine one or more prior art references identified in the claim charts attached as Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits D-1–D-9, Exhibits E-1–E-12, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8, and/or Appendices A–K with each other to address any contention from Plaintiff that a particular prior art item supposedly lacks one or more elements of an Asserted Claim. In other words, Defendants contend that each charted prior art reference can be combined with other charted prior art references when a particular prior art item lacks or does not explicitly disclose an element or feature of an Asserted Claim. For example:

a) Exemplary Motivation to Combine for the ’631 Patent

(1) R3-173152 in view of TR 38.801 V0.4.0

To the extent the references charted in Exhibits A-1-A-15 do not disclose every limitation of the ’631 patent, it would have been obvious to combine R3-173152 charted in Exhibit A-1 with TR 38.801 V0.4.0 charted in Exhibit A4, each of which discloses every claim of the ’631 patent as shown in A-1 and A-4. Both R3-173152 and TR 38.801 V0.4.0 are in the same field of telecommunications and relate to the same functionality, specifically performing a network slice-

aware handover of a user equipment from a source base station to a target base station. Further, both references discuss the transmitting network slice information. R3-173152 was presented in August 2017 at 3GPP TSG RAN WG3 meeting #97 and TR 38.801 V0.4.0 was published September 13, 2016. Thus, both references originate from approximately the same time period. Additionally, R3-173152 was presented at 3GPP TSG RAN WG2 meeting #85bis, and TR 38.801 V0.4.0 is a 3GPP technical report. Thus, it would have been obvious to a POSITA to combine the teachings of both R3-173152 and TR 38.801 V0.4.0 as they were both related to the ongoing work prior to the earliest priority date of the '631 patent related to performing a network slice-aware handover of a user equipment from a source base station to a target base station and transmitting network slice information.

(2) Han 222 in view of TR 38.801 V0.4.0

To the extent the references charted in Exhibits A-1-A-15 do not disclose every limitation of the '631 patent, it would have been obvious to combine Han 222 charted in Exhibit A-2 with TR 38.801 V0.4.0 charted in Exhibit A-4, each of which discloses every claim of the '631 patent as shown in A-2 and A-4. Both Han 222 and TR 38.801 V0.4.0 are in the same field of telecommunications and relate to the same functionality, ensuring end-to-end quality of service by performing network slice-aware handover of a user equipment from a source base station to a target base station. Further, both references discuss sending network slice information. Han 222 was filed on March 29, 2019, and claims priority to a Chinese application filed on September 30, 2016. Likewise, TR 38.801 V0.4.0 was published September 13, 2016. Thus, both references originate from approximately the same time period. Thus, it would have been obvious to a POSITA to combine the teachings of both Han 222 and TR 38.801 V0.4.0 as they were both related to the ongoing work prior to the earliest priority date of the '631 patent related to ensuring end-to-end

quality of service by performing network slice-aware handover of a user equipment from a source base station to a target base station and transmitting network slice information.

(3) Futaki 635 in view of TR 38.801 V0.4.0

To the extent the references charted in Exhibits A-1-A-15 do not disclose every limitation of the ’631 patent, it would have been obvious to combine Futaki 635 charted in Exhibit A-3 with TR 38.801 V0.4.0 charted in Exhibit A4, each of which discloses every claim of the ’631 patent as shown in A-3 and A-4. Both Futaki 635 and TR 38.801 V0.4.0 are in the same field of telecommunications and relate to the same functionality, specifically handing over a radio terminal from a source base station to a target base station and ensuring support of network slices. Further, both references discuss transmitting network slice information. Futaki 635 was filed on May 15, 2017, and claims priority to a Japanese application filed on August 10, 2016. Likewise, TR 38.801 V0.4.0 was published September 13, 2016. Thus, both references originate from approximately the same time period. Thus, it would have been obvious to a POSITA to combine the teachings of both Futaki 635 and TR 38.801 V0.4.0 as they were both related to the ongoing work prior to the earliest priority date of the ’631 patent related to handing over a radio terminal from a source base station to a target base station and ensuring support of network slices and transmitting network slice information.

(4) Han 222 in view of TS 36.300 V13.4.0

To the extent the references charted in Exhibits A-1-A-15 do not disclose every limitation of the ’631 patent, it would have been obvious to combine Han 222 charted in Exhibit A-2 with TS 36.300 V0.4.0 charted in Exhibit A-15, each of which discloses every claim of the ’631 patent as shown in A-2 and A-15. Both Han 222 and TS 36.300 V0.4.0 are in the same field of telecommunications and relate to the same functionality, ensuring end-to-end quality of service by

performing network slice-aware handover of a user equipment from a source base station to a target base station. Further, both references discuss sending network slice information. Han 222 was filed on March 29, 2019, and claims priority to a Chinese application filed on September 30, 2016. Likewise, TS 36.300 V0.4.0 was published July 7, 2016. Thus, both references originate from approximately the same time period. Thus, it would have been obvious to a POSITA to combine the teachings of both Han 222 and TS 36.300 V0.4.0 as they were both related to the ongoing work prior to the earliest priority date of the '631 patent related to ensuring end-to-end quality of service by performing network slice-aware handover of a user equipment from a source base station to a target base station and transmitting network slice information.

(5) Additional References

To the extent the references charted in Exhibits A-1–A-15 do not disclose "[a] method for transmitting and receiving data," "[a] controller for transmitting and receiving data," or "[a]n apparatus for transmitting and receiving data," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1-A-15. A person of skill in the art would be motivated to combine these references because the references all disclose a method for transmitting and receiving data, a controller for transmitting and receiving data, and an apparatus for transmitting and receiving data. *See, e.g.*, Ex. A-1 (R3-173152) at 1[pre], 7[pre], 13[pre]; Ex. A-2 (Han 222) at 1[pre], 7[pre], 13[pre]; Ex. A-3 (Futaki 635) at 1[pre], 7[pre], 13[pre]; Ex. A-4 (TR 38.801 V0.4.0) at 1[pre], 7[pre], 13[pre]; Ex. A-5 (Futaki 854) at 1[pre], 7[pre], 13[pre]; Ex. A-6 (Zee) at 1[pre], 7[pre], 13[pre]; Ex. A-7 (Han 724) at 1[pre], 7[pre], 13[pre]; Ex. A-8 (Liang) at 1[pre], 7[pre], 13[pre]; Ex. A-9 (Byun) at 1[pre], 7[pre], 13[pre]; Ex. A-10 (Yu) at 1[pre], 7[pre], 13[pre]; Ex. A-11 (R3-171116) at 1[pre], 7[pre], 13[pre]; Ex. A-

12 (R3-171029) at 1[pre], 7[pre], 13[pre]; Ex. A-13 (R3-170065) at 1[pre], 7[pre], 13[pre]; Ex. A-14 (R3-173614) at 1[pre], 7[pre], 13[pre]; Ex. A-15 (TS 36.300 V13.4.0) at 1[pre], 7[pre], 13[pre]. The '631 patent further admits that various methods were known in the art for transmitting and receiving data ('631 patent at 1:28-55, 5:8-13). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "[a] method for transmitting and receiving data," "[a] controller for transmitting and receiving data," or "[a]n apparatus for transmitting and receiving data," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose a method for transmitting and receiving data, a controller for transmitting and receiving data, and an apparatus for transmitting and receiving data. *See, e.g.*, Appendix A at 1[pre], 7[pre], 13[pre]. The '631 patent further admits that various methods were known in the art for transmitting and receiving data ('631 patent at 1:28-55, 5:8-13). It is the nature of the communications field such as this to combine

ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "deciding, by a source base station (BS), whether to perform a handover," "to decide whether to perform a handover," or "a controller configured to decide whether to perform a handover," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1-A-15. A person of skill in the art would be motivated to combine these references because the references all disclose deciding, by a source base station (BS), whether to perform a handover, to decide whether to perform a handover, and a controller configured to decide whether to perform a handover. *See, e.g.*, Ex. A-1 (R3-173152) at 1[a], 7[b], 13[a]; Ex. A-2 (Han 222) at 1[a], 7[b], 13[a]; Ex. A-3 (Futaki 635) at 1[a], 7[b], 13[a]; Ex. A-4 (TR 38.801 V0.4.0) at 1[a], 7[b], 13[a]; Ex. A-5 (Futaki 854) at 1[a], 7[b], 13[a]; Ex. A-6 (Zee) at 1[a], 7[b], 13[a]; Ex. A-7 (Han 724) at 1[a], 7[b], 13[a]; Ex. A-8 (Liang) at 1[a], 7[b], 13[a]; Ex. A-9 (Byun) at 1[a], 7[b], 13[a]; Ex. A-10 (Yu) at 1[a], 7[b], 13[a]; Ex. A-11 (R3-171116) at 1[a], 7[b], 13[a]; Ex. A-12 (R3-171029) at 1[a], 7[b], 13[a]; Ex. A-13 (R3-170065) at 1[a], 7[b], 13[a]; Ex. A-14 (R3-173614)

at 1[a], 7[b], 13[a]; Ex. A-15 (TS 36.300 V13.4.0) at 1[a], 7[b], 13[a]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "deciding, by a source base station (BS), whether to perform a handover," "to decide whether to perform a handover," or "a controller configured to decide whether to perform a handover," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose deciding, by a source base station (BS), whether to perform a handover, to decide whether to perform a handover, and a controller configured to decide whether to perform a handover. *See, e.g.*, Appendix A at 1[a], 7[b], 13[a]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements

according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "transmitting, from the source BS to a target BS, a handover request message when it is decided to perform the handover," "to transmit a handover request message when it is decided to perform the handover," or "a transmitter configured to transmit a handover request message when it is decided to perform the handover," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting, from the source BS to a target BS, a handover request message when it is decided to perform the handover, to transmit a handover request message when it is decided to perform the handover, and a transmitter configured to transmit a handover request message when it is decided to perform the handover. *See, e.g.*, Ex. A-1 (R3-173152) at 1[b], 7[c], 13[b]; Ex. A-2 (Han 222) at 1[b], 7[c], 13[b]; Ex. A-3 (Futaki 635) at 1[b], 7[c], 13[b]; Ex. A-4 (TR 38.801 V0.4.0) at 1[b], 7[c], 13[b]; Ex. A-5 (Futaki 854) at 1[b], 7[c], 13[b]; Ex. A-6 (Zee) at 1[b], 7[c], 13[b]; Ex. A-7 (Han 724) at 1[b], 7[c], 13[b]; Ex. A-8 (Liang) at 1[b], 7[c], 13[b]; Ex. A-9 (Byun) at 1[b], 7[c], 13[b]; Ex. A-10 (Yu) at 1[b], 7[c], 13[b]; Ex. A-11 (R3-171116) at 1[b], 7[c], 13[b]; Ex. A-12 (R3-171029) at 1[b], 7[c], 13[b]; Ex. A-13 (R3-170065) at 1[b], 7[c], 13[b]; Ex. A-14 (R3-173614) at 1[b], 7[c], 13[b]; Ex. A-15 (TS 36.300 V13.4.0) at 1[b], 7[c], 13[b]. It is the nature of the communications field such as this

to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "transmitting, from the source BS to a target BS, a handover request message when it is decided to perform the handover," "to transmit a handover request message when it is decided to perform the handover," or "a transmitter configured to transmit a handover request message when it is decided to perform the handover," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting, from the source BS to a target BS, a handover request message when it is decided to perform the handover, to transmit a handover request message when it is decided to perform the handover, and a transmitter configured to transmit a handover request message when it is decided to perform the handover. *See, e.g.*, Appendix A at 1[b], 7[c], 13[b]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof,

to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "wherein the handover request message includes network slice information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose the handover request message includes network slice information. *See, e.g.*, Ex. A-1 (R3-173152) at 1[c], 7[d], 13[c]; Ex. A-2 (Han 222) at 1[c], 7[d], 13[c]; Ex. A-3 (Futaki 635) at 1[c], 7[d], 13[c]; Ex. A-4 (TR 38.801 V0.4.0) at 1[c], 7[d], 13[c]; Ex. A-5 (Futaki 854) at 1[c], 7[d], 13[c]; Ex. A-6 (Zee) at 1[c], 7[d], 13[c]; Ex. A7 (Han 724) at 1[c], 7[d], 13[c]; Ex. A-8 (Liang) at 1[c], 7[d], 13[c]; Ex. A-9 (Byun) at 1[c], 7[d], 13[c]; Ex. A-10 (Yu) at 1[c], 7[d], 13[c]; Ex. A-11 (R3-171116) at 1[c], 7[d], 13[c]; Ex. A-12 (R3-171029) at 1[c], 7[d], 13[c]; Ex. A-13 (R3-170065) at 1[c], 7[d], 13[c]; Ex. A-14 (R3-173614) at 1[c], 7[d], 13[c]; Ex. A-15 (TS 36.300 V13.4.0) at 1[c], 7[d], 13[c]. The '631 patent further admits that various methods were known in the art for network slice information ('631 patent at 1:28-55, 7:12-8:9). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the

above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "wherein the handover request message includes network slice information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose the handover request message includes network slice information. *See, e.g.*, Appendix A at 1[c], 7[d], 13[c]. The '631 patent further admits that various methods were known in the art for network slice information ('631 patent at 1:28-55, 7:12-8:9). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover,

these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "receiving, by the source BS from the target BS, a handover request confirmation message in response to the handover request message," "to receive a handover request confirmation message in response to the handover request message," or "a receiver configured to receive a handover request confirmation message in response to the handover request message," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, by the source BS from the target BS, a handover request confirmation message in response to the handover request message, to receive a handover request confirmation message in response to the handover request message, and a receiver configured to receive a handover request confirmation message in response to the handover request message. *See, e.g.*, Ex. A-1 (R3-173152) at 1[d], 7[e], 13[d]; Ex. A-2 (Han 222) at 1[d], 7[e], 13[d]; Ex. A-3 (Futaki 635) at 1[d], 7[e], 13[d]; Ex. A-4 (TR 38.801 V0.4.0) at 1[d], 7[e], 13[d]; Ex. A-5 (Futaki 854) at 1[d], 7[e], 13[d]; Ex. A-6 (Zee) at 1[d], 7[e], 13[d]; Ex. A-7 (Han 724) at 1[d], 7[e], 13[d]; Ex. A-8 (Liang) at 1[d], 7[e], 13[d]; Ex. A-9 (Byun) at 1[d], 7[e], 13[d]; Ex. A-10 (Yu) at 1[d], 7[e], 13[d]; Ex. A-11 (R3-171116) at 1[d], 7[e], 13[d]; Ex. A-12 (R3-171029) at 1[d], 7[e], 13[d]; Ex. A-13 (R3-170065) at 1[d], 7[e], 13[d]; Ex. A-14 (R3-173614) at 1[d], 7[e], 13[d]; Ex. A-15 (TS 36.300 V13.4.0) at 1[d], 7[e], 13[d]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and

variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "receiving, by the source BS from the target BS, a handover request confirmation message in response to the handover request message," "to receive a handover request confirmation message in response to the handover request message," or "a receiver configured to receive a handover request confirmation message in response to the handover request message," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, by the source BS from the target BS, a handover request confirmation message in response to the handover request message, to receive a handover request confirmation message in response to the handover request message, and a receiver configured to receive a handover request confirmation message in response to the handover request message. *See, e.g.*, Appendix A at 1[d], 7[e], 13[d]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also

have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "wherein, if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by the target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by the target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS. *See, e.g.*, Ex. A-1 (R3-173152) at 1[e], 7[f], 13[e]; Ex. A-2 (Han 222) at 1[e], 7[f], 13[e]; Ex. A-3 (Futaki 635) at 1[e], 7[f], 13[e]; Ex. A-4 (TR 38.801 V0.4.0) at 1[e], 7[f], 13[e]; Ex. A-5 (Futaki 854) at 1[e], 7[f], 13[e]; Ex. A-6 (Zee) at 1[e], 7[f], 13[e]; Ex. A-7 (Han 724) at 1[e], 7[f], 13[e]; Ex. A-8 (Liang) at 1[e], 7[f], 13[e]; Ex. A-9 (Byun) at 1[e], 7[f], 13[e]; Ex. A-10 (Yu) at 1[e], 7[f], 13[e]; Ex. A-11 (R3-171116) at 1[e], 7[f], 13[e]; Ex. A-12 (R3-171029) at 1[e], 7[f], 13[e]; Ex. A-13 (R3-170065) at 1[e], 7[f], 13[e]; Ex. A-14 (R3-173614) at 1[e], 7[f], 13[e]; Ex. A-15 (TS 36.300 V13.4.0) at 1[e], 7[f], 13[e]. It is the nature of the

communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "wherein, if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by the target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by the target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS. *See, e.g.*, Appendix A at 1[e], 7[f], 13[e]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These

combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "receiving, by the source BS from a user equipment (UE), a non-access stratum (NAS) message including network slice request information," "the processor further performs to receive a non-access stratum (NAS) message including network slice request information," or "the processor further performs to receive a non-access stratum (NAS) message including network slice request information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, by the source BS from a user equipment (UE), a non-access stratum (NAS) message including network slice request information, the processor further performs to receive a non-access stratum (NAS) message including network slice request information, and the processor further performs to receive a non-access stratum (NAS) message including network slice request information. *See, e.g.*, Ex. A-1 (R3-173152) at 2, 8, 14; Ex. A-2 (Han 222) at 2, 8, 14; Ex. A-3 (Futaki 635) at 2, 8, 14; Ex. A-4 (TR 38.801 V0.4.0) at 2, 8, 14; Ex. A5 (Futaki 854) at 2, 8, 14; Ex. A-6 (Zee) at 2, 8, 14; Ex. A-7 (Han 724) at 2, 8, 14; Ex. A-8 (Liang) at 2, 8, 14; Ex. A-9 (Byun) at 2, 8, 14; Ex. A-10 (Yu) at 2, 8, 14; Ex. A-11 (R3-171116) at 2, 8, 14; Ex. A-12 (R3-171029) at 2, 8, 14; Ex. A-13 (R3-170065) at 2, 8, 14; Ex. A-

14 (R3-173614) at 2, 8, 14; Ex. A-15 (TS 36.300 V13.4.0) at 2, 8, 14. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "receiving, by the source BS from a user equipment (UE), a non-access stratum (NAS) message including network slice request information," "the processor further performs to receive a non-access stratum (NAS) message including network slice request information," or "the processor further performs to receive a non-access stratum (NAS) message including network slice request information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, by the source BS from a user equipment (UE), a non-access stratum (NAS) message including network slice request information, the processor further performs to receive a non-access stratum (NAS) message including network slice request information, and the processor further performs to receive a non-access stratum (NAS) message including network slice request information. *See, e.g.*, Appendix A at 2, 8, 14. It is the nature of

the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "receiving, by the source BS from a core network entity, the network slice information, wherein the network slice information is configured by the network slice request information," "the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information," or "the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, by the source BS from a core network entity, the network slice information, wherein the network slice information is configured by the network slice request information, the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request

information, and the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information. *See, e.g.*, Ex. A-1 (R3-173152) at 3, 9, 15; Ex. A-2 (Han 222) at 3, 9, 15; Ex. A-3 (Futaki 635) at 3, 9, 15; Ex. A-4 (TR 38.801 V0.4.0) at 3, 9, 15; Ex. A-5 (Futaki 854) at 3, 9, 15; Ex. A-6 (Zee) at 3, 9, 15; Ex. A-7 (Han 724) at 3, 9, 15; Ex. A-8 (Liang) at 3, 9, 15; Ex. A-9 (Byun) at 3, 9, 15; Ex. A-10 (Yu) at 3, 9, 15; Ex. A-11 (R3-171116) at 3, 9, 15; Ex. A-12 (R3-171029) at 3, 9, 15; Ex. A-13 (R3-170065) at 3, 9, 15; Ex. A-14 (R3-173614) at 3, 9, 15; Ex. A-15 (TS 36.300 V13.4.0) at 3, 9, 15. The '631 patent further admits that various methods were known in the art for network slice information ('631 patent at 1:28-55, 7:12-8:9). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "receiving, by the source BS from a core network entity, the network slice information, wherein the network slice information is configured by the network slice request information," "the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information," or "the processor further

performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, by the source BS from a core network entity, the network slice information, wherein the network slice information is configured by the network slice request information, the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information, and the processor further performs to receive the network slice information from a core network, wherein the network slice information is configured by the network slice request information. *See, e.g.*, Appendix A at 3, 9, 15. The '631 patent further admits that various methods were known in the art for network slice information ('631 patent at 1:28-55, 7:12-8:9). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "the NAS message including the network slice request information is included in a radio resource control (RRC) connection setup completion message," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15 . A person of skill in the art would be motivated to combine these references because the references all disclose the NAS message including the network slice request information is included in a radio resource control (RRC) connection setup completion message. *See, e.g.*, Ex. A-1 (R3-173152) at 4, 10, 16; Ex. A-2 (Han 222) at 4, 10, 16; Ex. A-3 (Futaki 635) at 4, 10, 16; Ex. A-4 (TR 38.801 V0.4.0) at 4, 10, 16; Ex. A-5 (Futaki 854) at 4, 10, 16; Ex. A-6 (Zee) at 4, 10, 16; Ex. A-7 (Han 724) at 4, 10, 16; Ex. A-8 (Liang) at 4, 10, 16; Ex. A-9 (Byun) at 4, 10, 16; Ex. A-10 (Yu) at 4, 10, 16; Ex. A-11 (R3-171116) at 4, 10, 16; Ex. A-12 (R3-171029) at 4, 10, 16; Ex. A-13 (R3-170065) at 4, 10, 16; Ex. A-14 (R3-173614) at 4, 10, 16; Ex. A-15 (TS 36.300 V13.4.0) at 4, 10, 16. The '631 patent further admits that various methods were known in the art for radio resource control (RRC) connection messages ('631 patent at 1:28-55, 6:12-14). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover,

these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "the NAS message including the network slice request information is included in a radio resource control (RRC) connection setup completion message," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose the NAS message including the network slice request information is included in a radio resource control (RRC) connection setup completion message. *See, e.g.*, Appendix A at 4, 10, 16. The '631 patent further admits that various methods were known in the art for radio resource control (RRC) connection messages ('631 patent at 1:28-55, 6:12-14). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "the network slice information is configured by the core network entity based on the network slice request

information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A-1–A-15. A person of skill in the art would be motivated to combine these references because the references all disclose the network slice information is configured by the core network entity based on the network slice request information. *See, e.g.*, Ex. A-1 (R3-173152) at 5, 11, 17; Ex. A-2 (Han 222) at 5, 11, 17; Ex. A-3 (Futaki 635) at 5, 11, 17; Ex. A-4 (TR 38.801 V0.4.0) at 5, 11, 17; Ex. A-5 (Futaki 854) at 5, 11, 17; Ex. A-6 (Zee) at 5, 11, 17; Ex. A-7 (Han 724) at 5, 11, 17; Ex. A-8 (Liang) at 5, 11, 17; Ex. A-9 (Byun) at 5, 11, 17; Ex. A-10 (Yu) at 5, 11, 17; Ex. A-11 (R3-171116) at 5, 11, 17; Ex. A-12 (R3-171029) at 5, 11, 17; Ex. A-13 (R3-170065) at 5, 11, 17; Ex. A-14 (R3-173614) at 5, 11, 17; Ex. A-15 (TS 36.300 V13.4.0) at 5, 11, 17. The '631 patent further admits that various methods were known in the art for network slice information ('631 patent at 1:28-55, 7:12-8:9). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "the network slice information is configured by the core network entity based on the network slice request

information," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose the network slice information is configured by the core network entity based on the network slice request information. *See, e.g.*, Appendix A 5, 11, 17. The '631 patent further admits that various methods were known in the art for network slice information ('631 patent at 1:28-55, 7:12-8:9). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "the transmission of the handover request message is performed through a direct interface associated with the target base station," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the other references charted in Exhibits A-1–A-15, each of which discloses this limitation as shown in Exhibits A1-A14. A person of skill in the art would be motivated to combine these references because the references all disclose the transmission of the handover request message is performed through a direct interface associated with the target base station. *See,*

e.g., Ex. A-1 (R3-173152) at 6, 12, 18; Ex. A-2 (Han 222) at 6, 12, 18; Ex. A-3 (Futaki 635) at 6, 12, 18; Ex. A-4 (TR 38.801 V0.4.0) at 6, 12, 18; Ex. A-5 (Futaki 854) at 6, 12, 18; Ex. A-6 (Zee) at 6, 12, 18; Ex. A-7 (Han 724) at 6, 12, 18; Ex. A-8 (Liang) at 6, 12, 18; Ex. A-9 (Byun) at 6, 12, 18; Ex. A-10 (Yu) at 6, 12, 18; Ex. A-11 (R3-171116) at 6, 12, 18; Ex. A-12 (R3-171029) at 6, 12, 18; Ex. A-13 (R3-170065) at 6, 12, 18; Ex. A-14 (R3-173614) at 6, 12, 18; Ex. A-15 (TS 36.300 V13.4.0) at 6, 12, 18. The '631 patent further admits that various methods were known in the art for transmission through a direct interface associated with the target base station ('631 patent at 1:28-55, 5:37-59). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits A-1–A-15 do not disclose "the transmission of the handover request message is performed through a direct interface associated with the target base station," it would have been obvious to combine any of the references charted in Exhibits A-1–A-15 with any of the references charted in Appendix A, each of which discloses this limitation as shown in Appendix A. A person of skill in the art would be motivated to combine these references because the references all disclose the transmission of the handover request message is

performed through a direct interface associated with the target base station. *See, e.g.*, Appendix A at 6, 12, 18. The '631 patent further admits that various methods were known in the art for transmission through a direct interface associated with the target base station ('631 patent at 1:28-55, 5:37-59). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

b) Exemplary Motivation to Combine for the '931 Patent

(1) Lee and ZTE

To the extent the references charted in Exhibits B-1–B-9 do not disclose every limitation of the '931 Patent it would have been obvious to combine Lee charted in Exhibit B-4 with ZTE charted in Exhibit B-5 each of which discloses every claim of the '931 Patent as shown in B-4 and B-5. Both Lee and ZTE are in the same technical field of telecommunications. Specifically, they

are both related to the narrow subset of Machine Type Communication in an LTE communications system. They are directed towards similar issues: coverage enhancement for Machine Type Communications. Lee is assigned to InterDigital Patent Holdings, Inc. ("InterDigital") who participated in 3GPP WG1 Meeting #74, which is the meeting at which ZTE was initially presented and proposed. 3GPP documents are cited on the face of Lee. In this way, a POSITA would have a clear motivation to combine Lee and ZTE. Further, the provisional application to which Lee claims priority was filed in August 2013. ZTE was presented at the 3GPP meeting which took place in August 2013. Thus, two references were drafted and proposed around the same time which further evidences a POSITA's motivation to combine ZTE and Lee.

(2) Zhang and ZTE

To the extent the references charted in Exhibits B-1–B-9 do not disclose every limitation of the '931 Patent it would have been obvious to combine Zhang charted in Exhibit B-6 with ZTE charted in Exhibit B-5 each of which discloses every claim of the '931 Patent as shown in B-6 and B-5. Both Zhang and ZTE are in the same field of telecommunications. Zhang is related to resource allocation, and ZTE discloses methods for resource allocation. Further, both Zhang and ZTE are directly related to physical channels, including transmission on the physical uplink control channel (PUCCH). Further, Zhang is assigned to Nokia Siemens Networks OY ("Nokia") who is a member of the 3rd Generation Partnership Project and participated in 3GPP WG1 Meeting #74. ZTE was presented and proposed at this meeting. 3GPP documents are also cited on the face of Zhang. For this reasons, a POSITA would have been motivated to combine Zhang and ZTE.

(3) Zhang and Lee

To the extent the references charted in Exhibits B-1–B-9 do not disclose every limitation of the '931 Patent it would have been obvious to combine Zhang charted in Exhibit B-6 with Lee

charted in Exhibit B-4 each of which discloses every claim of the '931 Patent as shown in B-6 and B-4. Both Zhang and Lee are in the same field of telecommunications. Zhang and Lee specifically teach methods related to an LTE telecommunications system. Zhang is related to resource allocation on physical uplink control channel (PUCCH), and Lee also discloses methods for resource control for PUCCH. Lee is related specifically to Machine Type Communications in an LTE telecommunications systems. It would have been obvious to a POSITA to apply the general methods disclosed by Zhang to the specific MTC UE-type. Further, Zhang is assigned to Nokia, and Lee is assigned to InterDigital. Both Nokia and InterDigital are members of the 3rd Generation Partnership Project, 3GPP documents are also cited on the face of both patents. For all of these reasons, a POSITA would have been motivated to combine Zhang and Lee.

(4) You and ZTE

To the extent the references charted in Exhibits B-1–B-9 do not disclose every limitation of the '931 Patent it would have been obvious to combine You charted in Exhibit B-1 with ZTE charted in Exhibit B-5 each of which discloses every claim of the '931 Patent as shown in B-1 and B-5. Both You and ZTE are in the same field of telecommunications and related to the same functionality, specifically Machine Type Communication in a LTE communication system. Further, both are related to resource allocation for control channels, including the Physical Uplink Control Channel (PUCCH). You claims priority to a provisional application filed on June 19, 2013, and ZTE was presented in August of 2013 at 3GPP TSG RAN WG1 Meeting #74, thus the references both came out of the same time period of Summer 2013. A POSITA would have been motivated to combine the teachings of ZTE as it relates to coverage enhancement for MTC terminals with the teachings of You. Further, You is assigned to LG Electronics, Inc. and has been since it was issued. ZTE was presented at 3GPP TSG RAN WG1 Meeting #74 which took place

from August 19, 2013 through August 23, 2013 in Barcelona, Spain. LG Electronics, Inc. was also a participant in this meeting and made its own contributions. Thus, it would have been obvious to a POSITA to combine the teachings of both You and ZTE as they were both related to the ongoing work prior to the earliest priority date of the '931 Patent related to Machine Type Communication in LTE systems and specifically, to coverage enhancement for MTC terminals in LTE.

(5) Kim and You

To the extent the references charted in Exhibits B-1–B-9 do not disclose every limitation of the '931 Patent it would have been obvious to combine Kim charted in B-2 with You charted in Exhibit B-1 each of which discloses every claim of the '931 Patent as shown in B-1 and B-2. Both Kim and You are in the same technical field related to communications in an LTE system. Kim is directed towards resource allocation, including resource allocation for PUCCH transmissions. Similarly, You is directed towards reception of a Machine Type Communication device, including a proposed method for resource assignment for PUCCH. As these two patents relate to similar functionality, a POSITA would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Kim related to PUCCH resource allocation with the MTC-specific teachings of You. Further, both patents are assigned to LG Electronics, Inc., and thus, a POSITA would have been motivated to combine their related teachings.

(6) Additional References

To the extent the references charted in Exhibits B-1–B-9 do not disclose "[a] method for transmitting response information of downlink data of a Machine Type Communication (MTC) terminal," or "a method for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station," it would have been obvious to

combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose a method for transmitting response information of downlink data of a Machine Type Communication (MTC) terminal and a method for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station. *See, e.g.*, Ex. B-1 ("You") at 1[pre], 3[pre]; Ex. B-2 ("Kim") at 1[pre], 3[pre]; Ex. B-3 ("Yang") at 1[pre], 3[pre]; Ex. B-4 ("Lee") at 1[pre], 3[pre]; Ex. B-5 ("ZTE") at 1[pre], 3[pre]; Ex. B-6 ("Zhang") at 1[pre], 3[pre]; Ex. B-7 ("Huawei") at 1[pre], 3[pre]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[pre], 3[pre]; Ex. B-9 ("Ericsson") at 1[pre], 3[pre]. The '931 patent further admits that various methods were known in the art for transmitting response information of downlink data of a Machine Type Communication (MTC) terminal and for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station ('931 at 6:40-7:11; 1:41-51). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "[a] method of transmitting response information of downlink data of a Machine Type Communication (MTC) terminal," or "[a] method of configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a method of transmitting response information of downlink data of a MTC terminal and a method of configuring a resource of response information of downlink data for a MTC terminal in a base station. *See, e.g.*, Appendix B at 1[pre], 3[pre]. The '931 patent further admits that various methods were known in the art for transmitting response information of downlink data of a Machine Type Communication (MTC) terminal and for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal in a base station ('931 at 6:40-7:11, 1:41-51). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel," or "transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose receiving and transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Ex. B-1 ("You") at 1[a], 3[a]; Ex. B-2 ("Kim") at 1[a], 3[a]; Ex. B-3 ("Yang") at 11[a], 3[a]; Ex. B-4 ("Lee") at 1[a], 3[a]; Ex. B-5 ("ZTE") at 1[a], 3[a]; Ex. B-6 ("Zhang") at 1[a], 3[a]; Ex. B-7 ("Huawei") at 1[a], 3[a]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[a], 3[a]; Ex. B-9 ("Ericsson") at 1[a], 3[a]. The '931 patent further admits that various methods were known in the art for receiving and transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel ('931 at 6:40-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and

complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "receiving structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel," or "transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving and transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Appendix B at 1[a], 3[a]. The '931 patent further admits that various methods were known in the art for receiving and transmitting structural information that contains at least one of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel ('931 patent at 6:28-61). It is the nature of the

communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "receiving downlink control information for scheduling the downlink data," or "transmitting downlink control information for scheduling the downlink data," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose receiving and transmitting downlink control information for scheduling the downlink data. *See, e.g.*, Ex. B-1 ("You") at 1[b], 3[b]; Ex. B-2 ("Kim") at 1[b], 3[b]; Ex. B-3 ("Yang") at 1[b], 3[b]; Ex. B-4 ("Lee") at 1[b], 3[b]; Ex. B-5 ("ZTE") at 1[b], 3[b]; Ex. B-6 ("Zhang") at 1[b], 3[b]; Ex. B-7 ("Huawei") at 1[b], 3[b]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[b], 3[b]; Ex. B-9 ("Ericsson") at 1[b], 3[b]. The '931 patent further admits that various methods were known in the art for receiving and transmitting downlink control information for scheduling the downlink data ('931 at 6:27-39; 5:31-45; 1:41-51; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of

ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "receiving downlink control information for scheduling the downlink data," or "transmitting downlink control information for scheduling the downlink data," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving and transmitting downlink control information for scheduling the downlink data. *See, e.g.*, Appendix B at 1[b], 3[b]. The '931 patent further admits that various methods were known in the art for receiving and transmitting downlink control information for scheduling the downlink data ('931 at 6:27-39; 5:31-45; 1:41-51; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified,

predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "receiving the downlink data," or "transmitting the downlink data" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose receiving and transmitting the downlink data. *See, e.g.*, Ex. B-1 ("You") at 1[c], 3[c]; Ex. B-2 ("Kim") at 1[c], 3[c]; Ex. B-3 ("Yang") at 1[c], 3[c]; Ex. B-4 ("Lee") at 1[c], 3[c]; Ex. B-5 ("ZTE") at 1[c], 3[c]; Ex. B-6 ("Zhang") at 1[c], 3[c]; Ex. B-7 ("Huawei") at 1[c], 3[c]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[c], 3[c]; Ex. B-9 ("Ericsson") at 1[c], 3[c]. The '931 patent further admits that various methods were known in the art for receiving and transmitting the downlink data ('931 at 1:41-51; 4:66-5:8; 6:28-39; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover,

these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "receiving downlink control information for scheduling the downlink data," or "transmitting downlink control information for scheduling the downlink data," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving and transmitting receiving and transmitting the downlink data. *See, e.g.*, Appendix B at 1[c], 3[c]. The '931 patent further admits that various methods were known in the art for receiving and transmitting the downlink data ('931 at 6:27-39; 5:31-45; 1:41-51). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "transmitting the response information on the downlink data by using the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-

9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting response information on the downlink data by using the resource allocated to the uplink control channel. *See, e.g.*, Ex. B-1 ("You") at 1[d]; Ex. B-2 ("Kim") at 1[d]; Ex. B-3 ("Yang") at 1[d]; Ex. B-4 ("Lee") at 1[d]; Ex. B-5 ("ZTE") at 1[d]; Ex. B-6 ("Zhang") at 1[d]; Ex. B-7 ("Huawei") at 1[d]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[d]; Ex. B-9 ("Ericsson") at 1[d]. The '931 patent further admits that various methods were known in the art for transmitting response information on the downlink data by using the resource allocated to the uplink control channel ('931 at 1:41-51; 5:31-42; 6:40-61; 6:62-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "transmitting the response information on the downlink data by using the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as

shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose transmitting response information on the downlink data by using the resource allocated to the uplink control channel. *See, e.g.*, Appendix B at 1[d]. The '931 patent further admits that various methods were known in the art for transmitting response information on the downlink data by using the resource allocated to the uplink control channel ('931 at 1:41-51; 5:31-42; 6:40-61; 6:62-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel" or "wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink

control channel; and iii) the start offset information on the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel and the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Ex. B-1 ("You") at 1[e], 3[d], 7[c]; Ex. B-2 ("Kim") at 1[e], 3[d], 7[c]; Ex. B-3 ("Yang") at 1[e], 3[d], 7[c]; Ex. B-4 ("Lee") at 1[e], 3[d], 7[c]; Ex. B-5 ("ZTE") at 1[e], 3[d], 7[c]; Ex. B-6 ("Zhang") at 1[e], 3[d], 7[c]; Ex. B-7 ("Huawei") at 1[e], 3[d], 7[c]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[e], 3[d], 7[c]; Ex. B-9 ("Ericsson") at 1[e], 3[d], 7[c]. The '931 patent further admits that various methods were known in the art for the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel and the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink

data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel ('931 at 1:41-51; 6:28-39; 6:40-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "wherein the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel" or "wherein the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as

shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose e the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel and the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Appendix B at 1[e], 3[d], 7[c]. The '931 patent further admits that various methods were known in the art for the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel and the resource of the uplink control channel for transmitting the response information of the downlink data is determined based on at least one piece of information on i) a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel ('931 at 1:41-51; 6:28-39; 6:40-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination

of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal" or "the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal and start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. *See, e.g.*, Ex. B-1 ("You") at 1[f], 3[e], 5[d], 7[d]; Ex. B-2 ("Kim") at 1[f], 3[e], 5[d], 7[d]; Ex. B-3 ("Yang") at 1[f], 3[e], 5[d], 7[d]; Ex. B-4 ("Lee") at 1[f], 3[e], 5[d], 7[d]; Ex. B-5 ("ZTE") at 1[f], 3[e], 5[d], 7[d]; Ex. B-6 ("Zhang") at 1[f], 3[e], 5[d], 7[d]; Ex. B-7 ("Huawei") at 1[f], 3[e], 5[d], 7[d]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[f], 3[e], 5[d], 7[d]; Ex. B-9 ("Ericsson") at 1[f], 3[e], 5[d], 7[d]. The '931 patent further admits that various methods were known in the art for start offset information of the resource allocated to the uplink control channel is configured separated from start offset

information for a terminal different from the MTC terminal and start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. ('931 at 1:41-51; 6:28-7:11; 7:12-24; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal" or "the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal and start

offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. *See, e.g.*, Appendix B at 1[f], 3[e], 5[d], 7[d]. The '931 patent further admits that various methods were known in the art for start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal and start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal. ('931 at 1:41-51; 6:28-7:11; 7:12-24; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station" or "a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer

signaling for the MTC terminal to the MTC terminal" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station and a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. *See, e.g.*, Ex. B-1 ("You") at 1[g], 3[f], 5[e], 7[e]; Ex. B-2 ("Kim") at 1[g], 3[f], 5[e], 7[e]; Ex. B-3 ("Yang") at 1[g], 3[f], 5[e], 7[e]; Ex. B-4 ("Lee") at 1[g], 3[f], 5[e], 7[e]; Ex. B-5 ("ZTE") at 1[g], 3[f], 5[e], 7[e]; Ex. B-6 ("Zhang") at 1[g], 3[f], 5[e], 7[e]; Ex. B-7 ("Huawei") at 1[g], 3[f], 5[e], 7[e]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[g], 3[f], 5[e], 7[e]; Ex. B-9 ("Ericsson") at 1[g], 3[f], 5[e], 7[e]. The '931 patent further admits that various methods were known in the art for a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station and a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. ('931 at 1:41-51; 6:25-27; 6:40-61; 6:62-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references,

and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station" or "a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station and a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. *See, e.g.*, Appendix B at 1[g], 3[f], 5[e], 7[e].

The ’931 patent further admits that various methods were known in the art for a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are received through cell-specific high layer signaling for the MTC terminal from a base station and a plurality of pieces of start offset information on the resource allocated to the uplink control channel are provided, and the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling for the MTC terminal to the MTC terminal. (’931 at 1:41-51; 6:25-27; 6:40-61; 6:62-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose “the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level” it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose start offset information on the resource allocated to

the uplink control channel is determined based on a coverage level. *See, e.g.*, Ex. B-1 ("You") at 1[h], 3[g], 5[f], 7[f]; Ex. B-2 ("Kim") at 1[h], 3[g], 5[f], 7[f]; Ex. B-3 ("Yang") at 1[h], 3[g], 5[f], 7[f]; Ex. B-4 ("Lee") at 1[h], 3[g], 5[f], 7[f]; Ex. B-5 ("ZTE") at 1[h], 3[g], 5[f], 7[f]; Ex. B-6 ("Zhang") at 1[h], 3[g], 5[f], 7[f]; Ex. B-7 ("Huawei") at 1[h], 3[g], 5[f], 7[f]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[h], 3[g], 5[f], 7[f]; Ex. B-9 ("Ericsson") at 1[h], 3[g], 5[f], 7[f]. The '931 patent further admits that various methods were known in the art for start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. ('931 at 1:41-51; 7:13-24; 6:28-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "the start offset information on the resource allocated to the uplink control channel is determined based on a coverage level" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose start offset information on the resource allocated to

the uplink control channel is determined based on a coverage level. *See, e.g.*, Appendix B at 1[h], 3[g], 5[f], 7[f]. The '931 patent further admits that various methods were known in the art for start offset information on the resource allocated to the uplink control channel is determined based on a coverage level. ('931 at 1:41-51; 7:13-24; 6:28-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly

transmitted. *See, e.g.*, Ex. B-1 ("You") at 1[i], 3[h], 5[g], 7[g]; Ex. B-2 ("Kim") at 1[i], 3[h], 5[g], 7[g]; Ex. B-3 ("Yang") at 1[i], 3[h], 5[g], 7[g]; Ex. B-4 ("Lee") at 1[i], 3[h], 5[g], 7[g]; Ex. B-5 ("ZTE") at 1[i], 3[h], 5[g], 7[g]; Ex. B-6 ("Zhang") at 1[i], 3[h], 5[g], 7[g]; Ex. B-7 ("Huawei") at 1[i], 3[h], 5[g], 7[g]; Ex. B-8 ("TS 36.213 v.11.3.0") at 1[i], 3[h], 5[g], 7[g]; Ex. B-9 ("Ericsson") at 1[i], 3[h], 5[g], 7[g]. The '931 patent further admits that various methods were known in the art for when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted ('931 at 1:41-51; 1:33-40; 7:25-36; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references

charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted. *See, e.g.*, Appendix B at 1[i], 3[h], 5[g], 7[g]. sThe '931 patent further admits that various methods were known in the art for when the response information of the downlink data of the MTC terminal is repeatedly transmitted, the repeated transmission is performed using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted ('931 at 1:41-51; 1:33-40; 7:25-36; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "[a] Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station," or "[a] base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal," it would have been obvious to combine

any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose a Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station and a base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. *See, e.g.*, Ex. B-1 ("You") at 5[pre], 7[pre]; Ex. B-2 ("Kim") at 5[pre], 7[pre]; Ex. B-3 ("Yang") at 5[pre], 7[pre]; Ex. B-4 ("Lee") at 5[pre], 7[pre]; Ex. B-5 ("ZTE") at 5[pre], 7[pre]; Ex. B-6 ("Zhang") at 5[pre], 7[pre]; Ex. B-7 ("Huawei") at 5[pre], 7[pre]; Ex. B-8 ("TS 36.213 v.11.3.0") at 5[pre], 7[pre]; Ex. B-9 ("Ericsson") at 5[pre], 7[pre]. The '931 patent further admits that various methods were known in the art a Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station and a base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal ('931 patent at 1:41-51; 1:33-40; 3:56-4:6; 4:23-37). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "[a] Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station," or "[a] base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal," it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station and a base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal. *See, e.g.*, Appendix B at 5[pre], 7[pre]. The '931 patent further admits that various methods were known in the art for a Machine Type Communication (MTC) terminal for transmitting response information of downlink data to a base station and a base station for configuring a resource of response information of downlink data for a Machine Type Communication (MTC) terminal ('931 patent at 1:41-51; 1:33-40; 3:56-4:6; 4:23-37). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover,

these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data. *See, e.g.*, Ex. B-1 ("You") at 5[a]; Ex. B-2 ("Kim") at 5[a]; Ex. B-3 ("Yang") at 5[a]; Ex. B-4 ("Lee") at 5[a]; Ex. B-5 ("ZTE") at 5[a]; Ex. B-6 ("Zhang") at 5[a]; Ex. B-7 ("Huawei") at 5[a]; Ex. B-8 ("TS 36.213 v.11.3.0") at 5[a]; Ex. B-9 ("Ericsson") at 5[a]. The '931 patent further admits that various methods were known in the art for a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data

('931 patent at 1:34-51; 6:40-61; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the

downlink data. *See, e.g.*, Appendix B at 5[a]. The '931 patent further admits that various methods were known in the art for a receiving unit configured to receive structural information that contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource to which the uplink control channel is allocated, configured to receive downlink control information for scheduling the downlink data, and configured to receive the downlink data ('931 patent at 1:34-51; 6:40-61; 7:37-63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose a transmitting unit configured to transmit structural information, downlink control information for scheduling the

downlink data, and the downlink data. *See, e.g.*, Ex. B-1 ("You") at 7[a]; Ex. B-2 ("Kim") at 7[a]; Ex. B-3 ("Yang") at 7[a]; Ex. B-4 ("Lee") at 7[a]; Ex. B-5 ("ZTE") at 7[a]; Ex. B-6 ("Zhang") at 7[a]; Ex. B-7 ("Huawei") at 7[a]; Ex. B-8 ("TS 36.213 v.11.3.0") at 7[a]; Ex. B-9 ("Ericsson") at 7[a]. The '931 patent further admits that various methods were known in the art for a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data ('931 patent at 1:41-51; 4:23-28; 5:60-65). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a transmitting unit configured to transmit structural information, downlink control information for scheduling the

downlink data, and the downlink data. *See, e.g.*, Appendix B at 7[a]. The '931 patent further admits that various methods were known in the art for a transmitting unit configured to transmit structural information, downlink control information for scheduling the downlink data, and the downlink data ('931 patent at 1:41-51; 4:23-28; 5:60-65). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Ex. B-1 ("You") at 7[b]; Ex. B-2 ("Kim") at 7[b];

Ex. B-3 ("Yang") at 7[b]; Ex. B-4 ("Lee") at 7[b]; Ex. B-5 ("ZTE") at 7[b]; Ex. B-6 ("Zhang") at 7[b]; Ex. B-7 ("Huawei") at 7[b]; Ex. B-8 ("TS 36.213 v.11.3.0") at 7[b]; Ex. B-9 ("Ericsson") at 7[b]. The '931 patent further admits that various methods were known in the art the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel ('931 patent at 6:40-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose the structural information contains at least one piece of i) information on a resource allocated to an uplink control

channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Appendix B at 7[b]. The '931 patent further admits that various methods were known in the art for the structural information contains at least one piece of i) information on a resource allocated to an uplink control channel for transmitting the response information and ii) start offset information on the resource allocated to the uplink control channel ('931 patent at 6:40-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to

combine these references because the references all disclose a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Ex. B-1 ("You") at 5[b]; Ex. B-2 ("Kim") at 5[b]; Ex. B-3 ("Yang") at 5[b]; Ex. B-4 ("Lee") at 5[b]; Ex. B-5 ("ZTE") at 5[b]; Ex. B-6 ("Zhang") at 5[b]; Ex. B-7 ("Huawei") at 5[b]; Ex. B-8 ("TS 36.213 v.11.3.0") at 5[b]; Ex. B-9 ("Ericsson") at 5[b]. The '931 patent further admits that various methods were known in the art a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel ('931 patent at1:41-51; 6:40-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel. *See, e.g.*, Appendix B at 5[b]. The '931 patent further admits that various methods were known in the art for a controller configured to determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel ('931 patent a t1:41-51; 6:40-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also

have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel. *See, e.g.*, Ex. B-1 ("You") at 5[c]; Ex. B-2 ("Kim") at 5[c]; Ex. B-3 ("Yang") at 5[c]; Ex. B-4 ("Lee") at 5[c]; Ex. B-5 ("ZTE") at 5[c]; Ex. B-6 ("Zhang") at 5[c]; Ex. B-7 ("Huawei") at 5[c]; Ex. B-8 ("TS 36.213 v.11.3.0") at 5[c]; Ex. B-9 ("Ericsson") at 5[c]. The '931 patent further admits that various methods were known in the art for a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel ('931 patent at 6:40-7:11, 1:41-51). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a

combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose the references all disclose a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel. *See, e.g.*, Appendix B at 5[c]. The '931 patent further admits that various methods were known in the art for the references all disclose a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel ('931 patent at 6:40-7:11, 1:41-51). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been

a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the other references charted in Exhibits B-1–B-9, each of which discloses this limitation as shown in B-1–B-9. A person of skill in the art would be motivated to combine these references because the references all disclose at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal. *See, e.g.*, Ex. B-1 ("You") at 2, 4, and 6; Ex. B-2 ("Kim") at 2, 4, and 6; Ex. B-3 ("Yang") at 2, 4, and 6; Ex. B-4 ("Lee") at 2, 4, and 6; Ex. B-5 ("ZTE") at 2, 4, and 6; Ex. B-6 ("Zhang") at 2, 4, and 6; Ex. B-7 ("Huawei") at 2, 4, and 6; Ex. B-8 ("TS 36.213 v.11.3.0") at 2, 4, and 6; Ex. B-9 ("Ericsson") at 2, 4, and 6. The '931 patent further admits that various methods were known in the art for at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal ('931 patent at '931 at 1:41-51; 7:13-24; 6:28-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and

there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits B-1–B-9 do not disclose "at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal" it would have been obvious to combine any of the references charted in Exhibits B-1–B-9 with any of the references charted in Appendix B, each of which discloses this limitation as shown in Appendix B. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level of the MTC terminal. *See, e.g.*, Appendix B at claims 2, 4, and 6. The '931 patent further admits that various methods were known in the art for the references all disclose a transmitting unit configured to transmit the response information of the downlink data by using the determined resource of the uplink control channel ('931 patent at 1:41-51; 7:13-24; 6:28-7:11). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in

the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

c) Exemplary Motivation to Combine for the '932 Patent

(1) Zhang '752 in view of Lin '881

To the extent the references charted in Exhibits C-1–C-6 do not disclose every limitation of the '932 Patent it would have been obvious to combine Lin '881 charted in Exhibit C-1 with Zhang '752 charted in Exhibit C-2 both of which disclose every claim of the '932 Patent as shown in C-1 and C-2. A POSITA would be motivated to combine Zhang '752 and Lin '881 because both are in the same field of telecommunications and relate to the same functionality, specifically communication of RRC messages between base stations. A POSITA would further be motivated to combine Lin '881 with Zhang '752 due to the presence of a common inventor of Bo Lin and a common assignee of Huawei. Thus, a POSITA would have motivated to combine two inventions developed by at least one of the same inventors, at the same company.

(2) Lin '876 in view of Lin '881

To the extent the references charted in Exhibits C-1–C-6 do not disclose every limitation of the '932 Patent it would have been obvious to combine Lin '881 charted in Exhibit C-1 with Lin '876 charted in Exhibit C-3 both of which disclose every claim of the '932 Patent as shown in C-1 and C-3. A person of ordinary skill in the art would have been motivated to combine Lin '881 and Lin '876 because both are in the same field of telecommunications and relate to the same

functionality, specifically communication of RRC messages between base stations. For example, both Lin '881 and Lin '876 disclose communications occurring over the X2 interface between base stations, including the content of and methods related to the transmission of messages on that interface. A POSITA would further be motivated to combine Lin '881 with Lin '876 due to the presence of a common first named inventor of Bo Lin and a common assignee of Huawei. Further, a POSITA would recognize that both Lin '881 and Lin '876 depend from the same PCT application: PCT/CN2014/089300, filed on Oct. 23, 2014. Thus, a POSITA would have motivated to combine both inventions developed by at least one of the same inventors, at the same company, at the same time.

(3) Lin '876 in view Zhang '752

To the extent the references charted in Exhibits C-1–C-6 do not disclose every limitation of the '932 Patent it would have been obvious to combine Lin '876 charted in Exhibit C-3 with Zhang '752 charted in Exhibit C-2 both of which disclose every claim of the '932 Patent as shown in C-2 and C-3. A person of ordinary skill in the art would have been motivated to combine Lin '876 and Zhang '752 because both are in the same field of telecommunications and relate to the same functionality, specifically communication of RRC messages between base stations. A POSITA would further be motivated to combine Lin '881 with Zhang '752 due to the presence of a common inventor of Bo Lin and a common assignee of Huawei. Thus, a POSITA would have motivated to combine both inventions developed by at least one of the same inventors, at the same company.

(4) Zhang '752 in view of Zhang '342

To the extent the references charted in Exhibits C-1–C-6 do not disclose every limitation of the '932 Patent it would have been obvious to combine Zhang '752 charted in Exhibit C-2 with

Zhang '342 charted in Exhibit C-5 both of which disclose every claim of the '932 Patent as shown in C-2 and C-5. A person of ordinary skill in the art would have been motivated to combine Zhang '752 and Zhang '342 because both are in the same field of telecommunications and relate to the same functionality, specifically communication of RRC messages between base stations. A POSITA would further be motivated to combine Zhang '752 and Zhang '342 due to the presence of a common assignee of Huawei. Further, a POSITA would recognize that both Zhang '752 and Zhang '342 were invented around the same time as both claim priority to PCT applications filed in 2013.

(5) Additional References

To the extent the references charted in Exhibits C-1–C-6 do not disclose "[a] method of configuring, by an access unit, a wireless connection of a terminal," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose a method of configuring a wireless connection of a terminal by an access unit. *See, e.g.*, Ex. C-1 Lin '881 at 1[pre], 8[pre]; Ex. C-2 Zhang '752 at 1[pre], 8[pre]; Ex. C-3 Lin '876 at 1[pre], 8[pre]; Ex. C-4 Xiong at 1[pre], 8[pre]; Ex. C-5 Zhang '342 at 1[pre], 8[pre]; Ex. C-6 R2-134005 at 1[pre], 8[pre]. The '932 patent further admits that various methods were known in the art for configuring a wireless connection of a terminal by an access unit ('932 patent at 4:20-5:34). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations

would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "[a] method of configuring, by an access unit, a wireless connection of a terminal," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a method of configuring a wireless connection of a terminal by an access unit. *See, e.g.*, Appendix C at 1[pre], 8[pre]. The '932 patent further admits that various methods were known in the art for configuring a wireless connection of a terminal by an access unit ('932 patent at 4:20-5:34). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the

result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "receiving an uplink radio resource control (RRC) message from a terminal, including the uplink RRC message into a first message, and transmitting the first message to a central unit," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose an access unit which receives an RRC message from a UE and transmits the message to a central unit. *See, e.g.*, Ex. C-1 Lin '881 at 1[pre], 8[pre]; Ex. C-2 Zhang '752 at 1[pre], 8[pre]; Ex. C-3 Lin '876 at 1[pre], 8[pre]; Ex. C-4 Xiong at 1[pre], 8[pre]; Ex. C-5 Zhang '342 at 1[pre], 8[pre]; Ex. C-6 R2-134005 at 1[pre], 8[pre]. The '932 patent further admits that various methods were known in the art for an access unit which receives an RRC message from a UE and transmits the message to a central unit ('932 patent at 4:60-5:6; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover,

these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "receiving an uplink radio resource control (RRC) message from a terminal, including the uplink RRC message into a first message, and transmitting the first message to a central unit," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose an access unit which receives an RRC message from a UE and transmits the message to a central unit. *See, e.g.*, Appendix C at 1[pre], 2[pre]. The '932 patent further admits that various methods were known in the art for an access unit which receives an RRC message from a UE and transmits the message to a central unit ('932 patent at 4:60-5:6; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "receiving a second message from the central unit, where the second message includes a downlink RRC message in response to the uplink RRC message from the terminal," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose receiving a downlink RRC message from a central unit in response to the uplink message from the terminal. *See, e.g.*, Ex. C-1 Lin '881 at 1[b], 8[b]; Ex. C-2 Zhang '752 at 1[b], 8[b]; Ex. C-3 Lin '876 at 1[b], 8[b]; Ex. C-4 Xiong at 1[b], 8[b]; Ex. C-5 Zhang '342 at 1[b], 8[b]; Ex. C-6 R2-134005 at 1[b], 8[b]. The '932 patent further admits that various methods were known in the art for receiving a downlink RRC message from a central unit in response to the uplink message from the terminal ('932 patent at 4:60-5:6; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "receiving a second message from the central unit, where the second message includes a downlink RRC message in response to the uplink RRC message from the terminal," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving a downlink RRC message from a central unit in response to the uplink message from the terminal. *See, e.g.*, Appendix C at 1[b], 8[b]. The '932 patent further admits that various methods were known in the art for receiving a downlink RRC message from a central unit in response to the uplink message from the terminal ('932 patent at 4:60-5:6; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "transmitting the downlink RRC message to the terminal," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–

C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting downlink RRC messages to a terminal. *See, e.g.*, Ex. C-1 Lin '881 at 1[c], 8[c]; Ex. C-2 Zhang '752 at 1[c], 8[c]; Ex. C-3 Lin '876 at 1[c], 8[c]; Ex. C-4 Xiong at 1[c], 8[c]; Ex. C-5 Zhang '342 at 1[c], 8[c]; Ex. C-6 R2-134005 at 1[c], 8[c]. The '932 patent further admits that various methods were known in the art for transmitting downlink RRC messages to a terminal ('932 patent at 4:4-16; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "transmitting the downlink RRC message to the terminal," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose transmitting downlink RRC messages to a terminal. *See, e.g.*, Appendix C at 1[c], 8[c]. The '932 patent further admits that various methods were known in the art for transmitting downlink RRC messages to a terminal

('932 patent at 4:4-16; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "wherein the access unit and the central unit distinguish signaling radio bearers based on radio bearer identification information-included in the first message and the second message," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose using different SRB types based on different types of messages. *See, e.g.*, Ex. C-1 Lin '881 at 1[d], 8[d]; Ex. C-2 Zhang '752 at 1[d], 8[d]; Ex. C-3 Lin '876 at 1[d], 8[d]; Ex. C-4 Xiong at 1[d], 8[d]; Ex. C-5 Zhang '342 at 1[d], 8[d]; Ex. C-6 R2-134005. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a

combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "wherein the access unit and the central unit distinguish signaling radio bearers based on radio bearer identification information-included in the first message and the second message," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose all disclose using different SRB types based on different types of messages. *See, e.g.*, Appendix C at 1[d], 8[d]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "wherein the access unit comprises a node configured to provide an RLC function, a MAC function, and a PHY function, for transmission of user plane data," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose an access node configured to transmit user plan data. *See, e.g.*, Ex. C-1 Lin '881 at 2[pre], 9[pre]; Ex. C-2 Zhang '752 at 2[pre], 9[pre]; Ex. C-3 Lin '876 at 2[pre], 9[pre]; Ex. C-4 Xiong at 2[pre], 9[pre]; Ex. C-5 Zhang '342 at 2[pre], 9[pre]; Ex. C-6 R2-134005 at 2[pre], 9[pre]. The '932 patent further admits that various methods were known in the art for an access node configured to transmit user plan data ('932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "wherein the access unit comprises a node configured to provide an RLC function, a MAC function, and a PHY function, for transmission of user plane data," it would have been obvious to combine any of the

references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose an access node configured to transmit user plan data. *See, e.g.*, Appendix C at 2[pre], 9[pre]. The '932 patent further admits that various methods were known in the art for an access node configured to transmit user plan data ('932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "the central unit comprises a node configured to provide a PDCP function, for transmission of the user plane data," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose a central node configured to transmit user plan data. *See, e.g.*, Ex. C-1 Lin '881 at 2[a], 9[a]; Ex. C-2 Zhang '752 at 2[a], 9[a]; Ex. C-3 Lin '876 at 2[a], 9[a]; Ex. C-4 Xiong at 2[a], 9[a]; Ex. C-5 Zhang '342 at 2[a], 9[a]; Ex. C-6 R2-134005 at 2[a],

9[a]. The '932 patent further admits that various methods were known in the art for a central node configured to transmit user plan data ('932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "the central unit comprises a node configured to provide a PDCP function, for transmission of the user plane data," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a central node configured to transmit user plan data. *See, e.g.*, Appendix C at 2[pre], 9[pre]. The '932 patent further admits that various methods were known in the art for a central node configured to transmit user plan data ('932 patent at 4:20-5:34; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and

variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "wherein the second message comprises at least one of an RRC connection setup message, a C-RNTI, and signaling radio bearer identification information," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the other references charted in Exhibits C-1–C-6, each of which discloses this limitation as shown in Exhibits C-1–C-6. A person of skill in the art would be motivated to combine these references because the references all disclose configuring communications sessions using RRC configuration messages. *See, e.g.*, Ex. C-1 Lin '881 at 4[a], 11[a]; Ex. C-2 Zhang '752 at 4[a], 11[a]; Ex. C-3 Lin '876 at 4[a], 11[a]; Ex. C-4 Xiong at 4[a], 11[a]; Ex. C-5 Zhang '342 at 4[a], 11[a]; Ex. C-6 R2-134005 at 4[a], 11[a]. The '932 patent further admits that various methods were known in the art for configuring communications sessions using RRC configuration messages ('932 patent at 4:20-5:34; '932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements

according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits C-1–C-6 do not disclose "wherein the second message comprises at least one of an RRC connection setup message, a C-RNTI, and signaling radio bearer identification information," it would have been obvious to combine any of the references charted in Exhibits C-1–C-6 with any of the references charted in Appendix C, each of which discloses this limitation as shown in Appendix C. A person of skill in the art would be motivated to combine these references because the references all disclose configuring communications sessions using RRC configuration messages. *See, e.g.*, Appendix C at 4[a], 11[a]. The '932 patent further admits that various methods were known in the art for configuring communications sessions using RRC configuration messages ('932 FH, 08-21-2019 Response to Office Action at 5-7). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations

would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

d) Exemplary Motivation to Combine for the '942 Patent

(1) Kuchibhotla in view of Rudolf

To the extent that the references charted in Exhibits D-1–D-9 do not disclose every limitation of the '942 Patent, it would have been obvious to combine Kuchibhotla, charted in Exhibit D-1 with Rudolf, charted in Exhibit D-2, each of which discloses every claim of the '942 Patent as shown in Exhibits D-1 and D-2. To solve the technical problem of efficiently allocating limited radio resources to in LTE and 5G communication networks configured with several usage services, a person of ordinary skill in the art would be motivated to combine these references for several reasons. Both references apply to the field of improving efficient communication in wireless devices: Kuchibhotla discloses a method and apparatus directed to wireless transmissions, signaling, and frame structures for devices configured for low latency data packets while maintaining backward compatibility with devices configured for normal latency data packets, while Rudolf discloses methods, systems, and apparatuses for using one or more radio resource allocation regions (RRARs) to preempt transmission of data for a first type of transmission and transmit data for a second type of transmissions. Both references mention the need for communication on multiple types of networks such as Long Term Evolution (LTE) networks, Wireless Local Area Networks (WLANs), and other wireless communication networks.

Kuchibhotla specifically mentions the need to develop communications systems that support a wider set of scenarios, while Rudolf lists out several such scenarios such as nhanced mobile broadband (eMBB), ultra-reliable low latency communication (URLLC), and massive machine-type communication (mMTC). Each of these communication types may have different transmission and latency requirements and networks may be required to efficiently allocate resources for each while minimizing conflicts and interference. Additionally, a POSITA would be motivated to combine references from the same time period, and both references were filed in 2016 and published in 2018 and 2019. Thus, a POSITA would be motivated to combine Kuchibhotla and Rudolf, and it would have been obvious to do so.

(2) Kuchibhotla in view of Samsung

To the extent that the references charted in Exhibits D-1–D-9 do not disclose every limitation of the ’942 Patent, it would have been obvious to combine Kuchibhotla, charted in Exhibit D-1, with R1-1609050 (“Samsung”), charted in Exhibit D-6, each of w which discloses every claim of the ’942 Patent as shown in Exhibits D-1 and D-6. To solve the technical problem of efficiently allocating limited radio resources to in 5G communication networks configured with several usage services, a person of ordinary skill in the art would be motivated to combine these references for several reasons. Both references disclose techniques for multiplexing to improve efficiency in communication systems. Kuchibhotla cites a number of references that specifically disclose using numerology for OFDM design, while Samsung is specifically focused on numerology as it relates to subcarrier spacing. Kuchibhotla discloses the need for communication systems to be compliant with 3GPP protocols, and a POSITA would look to 3GPP publications such as Samsung to ensure that the methods and apparatus in Kuchibhotla are 3GPP compliant. Additionally, a POSITA would be motivated to combine references from the same time period,

and Kuchibhotla was filed in 2016, the same year Samsung was published. Thus, a POSITA would be motivated to combine Kuchibhotla and Samsung, and it would have been obvious to do so.

(3) Kuchibhotla in view of Chen

To the extent that the references charted in Exhibits D-1–D-9 do not disclose every limitation of the '942 Patent, it would have been obvious to combine Kuchibhotla, charted in Exhibit D-1 with U.S. Patent Appl. No. 2016/0234857A1 ("Chen") (disclosures identified in Appendix D). Chen and Kuchibhotla are in the same field of endeavor, i.e., supporting both low latency and non-latency transmissions in the same subframe and providing notification of resources punctured for low latency data. A POSITA thus would have been motivated to look to Chen's teachings to use with Kuchibhotla's techniques. Further, a POSITA would have been motivated to combine Chen's multicast-type puncturing indicator with Kuchibhotla for at least the reason that sending the indicator to a common group of UEs, such as non-latency sensitive UEs, as a multicast is an efficient way to improve performance and reliability, as taught by Chen. Further, a POSITA would have been motivated to multicast Kuchibhotla's marker using a common search space of PDCCH in order to make efficient use of system and UE resources. A POSITA would have been motivated to send Kuchibhotla's "transmission common to multiple devices" as a multicast signal in a common search space of PDCCH that is monitored by a common group of UEs for at least the reason of reducing power consumption and overhead at the user equipment, as taught by Chen. Thus, a POSITA would be motivated to combine Kuchibhotla and Chen, and it would have been obvious to do so.

(4) Rudolf in view of Lee

To the extent that the references charted in Exhibits D-1–D-9 do not disclose every limitation of the '942 Patent, it would have been obvious to combine Rudolf, charted in Exhibit

D-2 with Lee, charted in Exhibit D-3, each of which discloses every claim of the '942 Patent as shown in Exhibits D-2 and D-3. To solve the technical problem of efficiently allocating limited radio resources to in 5G communication networks configured with several usage services, a person of ordinary skill in the art would be motivated to combine these references for several reasons. Both references apply to the field of preemption of communication resources in 5G: Rudolf discloses methods, systems, and apparatuses for using one or more radio resource allocation regions (RRARs) to preempt transmission of data for a first type of transmission and transmit data for a second type of transmissions, while Lee discloses receiving a fast UL grant request that requests a fast UL resource allocation for the urgent message transmission from the second UE. Furthermore, Rudolf discloses how different communication types may have different transmission and latency requirements. Lee specifically discloses that an object of its disclosure is to provide a method for transmitting and receiving a fast UL grant in order to support a new 5G low latency wireless service. Thus, a POSITA would be motivated to combine Rudolf and Lee, and it would have been obvious to do so.

(5) Rudolf in view of Samsung

To the extent that the references charted in Exhibits D-1–D-9 do not disclose every limitation of the '942 Patent, it would have been obvious to combine Rudolf, charted in Exhibit D-2 with Samsung, charted in Exhibit D-6, each of which discloses every claim of the '942 Patent as shown in Exhibits D-2 and D-6. To solve the technical problem of efficiently allocating limited radio resources to in 5G communication networks configured with several usage services, a person of ordinary skill in the art would be motivated to combine these references for several reasons. Both references specifically disclose the need to support a number of different communication types, including enhanced mobile broadband (eMBB), ultra-reliable low latency communication

(URLLC), and massive machine-type communication (mMTC) in 5G. Rudolf discloses methods related to both time domain and frequency domain multiplexing, and Samsung discloses using numerology to enhance multiplexing techniques. Rudolf discloses the need to support 3GPP access technologies, and a POSITA would look to 3GPP publications such as Samsung for guidance on support 3GPP access technologies. Additionally, a POSITA would be motivated to combine references from the same time period, and Rudolf was filed in 2016, the same year Samsung was published. Thus, a POSITA would be motivated to combine Rudolf and Samsung, and it would have been obvious to do so.

(6) Additional References

To the extent the references charted in Exhibits D-1–D-9 do not disclose "a method of receiving a downlink (DL) signal by a first user equipment (UE)," or "a method of transmitting a downlink (DL) signal by a base station (BS)," or "a user equipment (UE) for receiving a downlink (DL) signal" it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "a method of receiving a downlink (DL) signal by a first user equipment (UE)," or "a method of transmitting a downlink (DL) signal by a base station (BS)," or "a user equipment (UE) for receiving a downlink (DL) signal." *See, e.g.*, Exhibits D-1–D-9 at 1[pre], 5[pre], and 9[pre]. The '942 patent further admits that various methods were known in the art for "a method of receiving a downlink (DL) signal by a first user equipment (UE)," or "a method of transmitting a downlink (DL) signal by a base station (BS)," or "a user equipment (UE) for receiving a downlink (DL) signal." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to

achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "a method of receiving a downlink (DL) signal by a first user equipment (UE)," or "a method of transmitting a downlink (DL) signal by a base station (BS)," or "a user equipment (UE) for receiving a downlink (DL) signal" it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "a method of receiving a downlink (DL) signal by a first user equipment (UE)," or "a method of transmitting a downlink (DL) signal by a base station (BS)," or "a user equipment (UE) for receiving a downlink (DL) signal." *See, e.g.*, Appendix D at 1[pre], 5[pre], and 9[pre] The '942 patent further admits that various methods were known in the art for "a method of receiving a downlink (DL) signal by a first user equipment (UE)," or "a method of transmitting a downlink (DL) signal by a base station (BS)," or "a user equipment (UE) for receiving a downlink (DL) signal." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best

solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," or "configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information" and "transmitting, from the BS, the configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling," or "a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," or "configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information" and "transmitting, from the BS, the

configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling," or "a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling." *See, e.g.*, Exhibits D-1–D-9 at 1[a], 5[a-b], and 9[a]. The '942 patent further admits that various methods were known in the art for "receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," or "configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information" and "transmitting, from the BS, the configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling," or "a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," or "configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information" and "transmitting, from the BS, the configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling," or "a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," or "configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information" and "transmitting, from the BS, the configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling," or "a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling." *See, e.g.*, Appendix D at 1[a], 5[a-b], and 9[a]. The '942 patent further admits that various methods were known in the art for "receiving, by the first UE, a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling," or "configuring, by the BS, a specific radio network temporary identifier (RNTI) for DL preemption indication information" and "transmitting, from the BS, the

configured specific RNTI to a first user equipment (UE) through a UE-specific radio resource control (RRC) signaling," or "a receiver configured to receive a specific radio network temporary identifier (RNTI) for DL preemption indication information through a UE-specific radio resource control (RRC) signaling." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," or "after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based

on the received specific RNTI," or "after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI." *See, e.g.*, Exhibits D-1–D-9 at 1[b] and 8[b]. The '942 patent further admits that various methods were known in the art for "after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," or "after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," or "after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references

charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," or "after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI." *See, e.g.*, Appendix D at 1[b] and 8[b]. The '942 patent further admits that various methods were known in the art for "after receiving the specific RNTI, monitoring, by the first UE, a DL control channel for receiving the DL preemption indication information based on the received specific RNTI," or "after reception of the specific RNTI, a controller configured to monitor a DL control channel for receiving the DL preemption indication information based on the received specific RNTI." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "receiving, by the first UE, the DL preemption indication information through a multicast signal," or "transmitting,

from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal," or "wherein the receiver further configured to receive the DL preemption indication information through a multicast signal," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "receiving, by the first UE, the DL preemption indication information through a multicast signal," or "transmitting, from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal," or "wherein the receiver further configured to receive the DL preemption indication information through a multicast signal." *See, e.g.*, Exhibits D-1–D-9 at 1[c], 5[c], and 9[c]. The '942 patent further admits that various methods were known in the art for "receiving, by the first UE, the DL preemption indication information through a multicast signal," or "transmitting, from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal," or "wherein the receiver further configured to receive the DL preemption indication information through a multicast signal." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying

known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "receiving, by the first UE, the DL preemption indication information through a multicast signal," or "transmitting, from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal," or "wherein the receiver further configured to receive the DL preemption indication information through a multicast signal," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "receiving, by the first UE, the DL preemption indication information through a multicast signal," or "transmitting, from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal," or "wherein the receiver further configured to receive the DL preemption indication information through a multicast signal." *See, e.g.*, Appendix D at 1[c], 5[c], and 9[c]. The '942 patent further admits that various methods were known in the art for "receiving, by the first UE, the DL preemption indication information through a multicast signal," or "transmitting, from the BS, the DL preemption indication information based on the specific RNTI through a multicast signal," or "wherein the receiver further configured to receive the DL preemption indication information through a multicast signal." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a

combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI)," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI)." *See, e.g.*, Exhibits D-1–D-9 at 1[d], 5[d], and 9[d]. The '942 patent further admits that various methods were known in the art for "wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI)." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable

expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI)," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI)." *See, e.g.*, Appendix D at 1[d], 5[d], and 9[d]. The '942 patent further admits that various methods were known in the art for "wherein the specific RNTI transmitted through the UE specific RRC signaling is a newly defined RNTI other than at least a cell-RNTI (C-RNTI)." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received." *See, e.g.*, Exhibits D-1–D-9 at 1[e], 5[e], and 9[e]. The '942 patent further admits that various methods were known in the art for "wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received." *See, e.g.*, Appendix D at 1[e], 5[e], and 9[e]. The '942 patent further admits that various methods were known in the art for "wherein the DL preemption indication information indicates preempted resource information in a prior slot, which precedes a slot in which the DL preemption indication information is received." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the specific RNTI is received with information related to time and frequency" or "wherein the specific RNTI is transmitted with information related to time and frequency," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the specific RNTI is received with information related to time and frequency" or "wherein the specific RNTI is transmitted with information related to time and frequency." *See, e.g.*, Exhibits D-1–D-9 at 1[f], 5[f], and 9[f]. The '942 patent further admits that various methods were known in the art for "wherein the specific RNTI is received with information related to time and frequency" or "wherein the specific RNTI is transmitted with information related to time and frequency." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the specific RNTI is received with information related to time and frequency" or "wherein the specific

RNTI is transmitted with information related to time and frequency," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the specific RNTI is received with information related to time and frequency" or "wherein the specific RNTI is transmitted with information related to time and frequency." *See, e.g.*, Appendix D at 1[f], 5[f], and 9[f]. The '942 patent further admits that various methods were known in the art for "wherein the specific RNTI is received with information related to time and frequency" or "wherein the specific RNTI is transmitted with information related to time and frequency." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling" or "wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication

information by the first UE through the UE-specific RRC signaling," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling" or "wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication information by the first UE through the UE-specific RRC signaling." *See, e.g.*, Exhibits D-1–D-9 at 1[g], 5[g], and 9[g]. The '942 patent further admits that various methods were known in the art for "wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling" or "wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication information by the first UE through the UE-specific RRC signaling." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling" or "wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication information by the first UE through the UE-specific RRC signaling," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling" or "wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication information by the first UE through the UE-specific RRC signaling." *See, e.g.*, Appendix D at 1[g], 5[g], and 9[g]. The '942 patent further admits that various methods were known in the art for "wherein the information related to time and frequency is received for the reception of the DL preemption indication information through the UE-specific RRC signaling" or "wherein the information related to time and frequency is transmitted for a reception of the DL preemption indication information by the first UE through the UE-specific RRC signaling." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and

there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE." *See, e.g.*, Exhibits D-1–D-9 at 2[a], 6[a], and 10[a]. The '942 patent further admits that various methods were known in the art for "wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement

one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE." *See, e.g.*, Appendix D at 2[a], 6[a], and 10[a]. The '942 patent further admits that various methods were known in the art for "wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in

the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the DL preemption indication information is received through a common search space of the DL control channel," or "wherein the DL preemption indication information is transmitted through a common search space of the DL control channel," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the other references charted in Exhibits D-1–D-9, each of which discloses this limitation as shown in Exhibits D-1–D-9. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the DL preemption indication information is received through a common search space of the DL control channel," or "wherein the DL preemption indication information is transmitted through a common search space of the DL control channel." *See, e.g.*, Exhibits D-1–D-9 at 3[a], 7[a], and 11[a]. The '942 patent further admits that various methods were known in the art for "wherein the DL preemption indication information is received through a common search space of the DL control channel," or "wherein the DL preemption indication information is transmitted through a common search space of the DL control channel." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from

prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits D-1–D-9 do not disclose "wherein the DL preemption indication information is received through a common search space of the DL control channel," or "wherein the DL preemption indication information is transmitted through a common search space of the DL control channel," it would have been obvious to combine any of the references charted in Exhibits D-1–D-9 with any of the references charted in Appendix D, each of which discloses this limitation as shown in Appendix D. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the DL preemption indication information is received through a common search space of the DL control channel," or "wherein the DL preemption indication information is transmitted through a common search space of the DL control channel." *See, e.g.*, Appendix D at 3[a], 7[a], and 11[a]. The '942 patent further admits that various methods were known in the art for "wherein the DL preemption indication information is received through a common search space of the DL control channel," or "wherein the DL preemption indication information is transmitted through a common search space of the DL control channel." ('942 patent at 6:12-7:26). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success

to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

e) Exemplary Motivation to Combine for the '460 Patent

(1) TS 38.213 v15.1.0 in view of TS 38.214 v 15.1.0.

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine TS 38.213 v15.1.0 charted in Exhibit E-1 with TS 38.214 v 15.1.0 charted in Exhibit E-2, each of which discloses every claim of the '460 Patent as shown in E-1 and E-2.

Both references were developed as part of the 3rd Generation Partnership Project, in conjunction with the Technical Specification Group Radio Access Network, and have a focus on "NR." Moreover, both reference relate to "physical layer procedures" for "control" and "data" respectively. Specifically, both TS 38.213 and TS 38.214 are in the same field of telecommunications and relate to the same functionality, specifically PUCCH and PUSCH frequency hopping.

Both references were released within one day of each other, and thus, both references originate from approximately the same time period. Moreover, TS 38.213 cross references TS 38.214 24 times, and TS 38.214 cross references 38.213 six times. Thus, a POSITA would have been motivated to combine the teachings of both references, as they were both related to the

ongoing work prior to the application date of the '460 patent related PUCCH and PUSCH frequency hopping.

(2) 36.213 v14.2.0 and in view of Ouchi (or Ouchi in view of 36.213 v14.2.0)

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine 36.213 v14.2.0 charted in Exhibit E-5 with Ouchi charted in exhibit E-7.

36.213 v14.2.0 was developed as part of the 3rd Generation Partnership Project, and disclose (among other things) PUSCH frequency hopping. Ouchi, meanwhile, relates to a technique for a terminal device, a base station device, and a method that enable efficient sharing of channel state information. Ouchi specifically references 3GPP and its role in developing LTE communications, and includes citations to documents discussed at 3GPP RAN WG1 Meeting #79, which also included discussion of and revisions to TS 36.213

Ouchi also recognizes the use of frequency hopping parameters applied to one physical channel (such as PUSCH) can also be applied to other physical channels (such as PUCCH). Given the disclosures in 36.213 v14.2.0 regarding PUSCH frequency hopping, a person of ordinary skill in the art would be motivated to apply those teachings to the PUCCH in view of the teachings of Ouchi.

(3) Takeda in view of 36.213 v14.2.0

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine Takeda charted in E-6 with 36.213 v14.2.0 charted in Exhibit E-5.

Takeda discloses (among other things) procedures for frequency hopping on both PUSCH and PUCCH. Importantly, Takeda also acknowledges that releases 14 and 15 of 3GPP standards provide procedures for downlink and uplink communications. As such, a person of ordinary skill in the art would be motivated to apply the procedures detailed in 36.213 v14.2.0 to the disclosures of Takeda.

(4) Takeda in view of 36.213 v14.2.0, in further view of Huang

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine Takeda charted in E-6 with 36.213 v14.2.0 charted in Exhibit E-5 the disclosures of Huang identified in Appendix E.

Takeda discloses (among other things) procedures for frequency hopping on both PUSCH and PUCCH. Importantly, Takeda also acknowledges that releases 14 and 15 of 3GPP standards provide procedures for downlink and uplink communications. As such, a person of ordinary skill in the art would be motivated to apply the procedures detailed in 36.213 v14.2.0 to the disclosures of Takeda.

Huang, meanwhile, teaches that "Some aspects of 5G NR may be based on the 4G Long Term Evolution (LTE) standard. There exists a need for further improvements in 5G NR technology. Such improvements may also be applicable to other multi-access technologies and the telecommunication standards that employ such technologies." As such, a person of ordinary skill in the art would understand that Huang teaches to apply concepts from LTE (such as PUSCH frequency hopping) in the NR context, including by applying them to the 5G NR BWP. Huang also discloses "intra-slot hopping in LTE communications system" and explains that "intra-slot frequency hopping may be used in LTE (or 5G/NR, or other wireless standards) to provide

frequency diversity. Accordingly, a PUCCH may be moved from one frequency to another frequency, e.g., hopping."

Huang further provides an algorithm for PUCCH frequency hopping. As such, a person of ordinary skill in the art would know to combine the PUCCH frequency hopping defined by Huang with the PUSCH frequency hopping defined by Takeda in view of 36.213 v14.2.0.

(5) Dahlman or Mehari or 36.213 in view of Huang, (and optionally) in view of Baldemair.

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine Dahlman charted in E-3, Mehari charted in E-4, or 36.213 charted in E-5 with the disclosures of Huang identified in Appendix E and Baldemair identified in Appendix E.

Dahlman, Mehari and 36.213 v14.2.0 each disclose the implementation of PUSCH frequency hopping in the LTE, including the procedures and algorithms used therein. Huang, meanwhile, teaches that "Some aspects of 5G NR may be based on the 4G Long Term Evolution (LTE) standard. There exists a need for further improvements in 5G NR technology. Such improvements may also be applicable to other multi-access technologies and the telecommunication standards that employ such technologies." As such, a person of ordinary skill in the art would understand that Huang teaches to apply concepts from LTE (such as PUSCH frequency hopping) in the NR context, including by applying them to the 5G NR BWP. Optionally, a person of ordinary skill in the art would also understand that "[a] bandwidth part may be a part of a bandwidth available for a radio node for communicating, e.g. due to circuitry and/or configuration and/or regulations and/or a standard" as taught by Baldemair, and would therefore understand that both PUSCH and PUCCH frequency hopping algorithms are equally applicable to

both 4G and 5G NR BWP. Huang also discloses "intra-slot hopping in LTE communications system" and explains that "intra-slot frequency hopping may be used in LTE (or 5G/NR, or other wireless standards) to provide frequency diversity. Accordingly, a PUCCH may be moved from one frequency to another frequency, e.g., hopping."

Huang further provides an algorithm for PUCCH frequency hopping. As such, a person of ordinary skill in the art would know to combine the PUCCH frequency hopping defined by Huang with the PUSCH frequency hopping defined by Dahlman, Mehari and 36.213 v14.2.0, as applied to the 5G NR BWP as taught by Baldemair.

(6) Each of the LTE PUSCH-Hopping References, in view of one or more PUCCH-Hopping References, (and optionally) further in view of one or more BWP References

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine each reference disclose LTE PUSCH frequency hopping procedures (including but not limited to Dahlman (Exhibit E-3), Mehari (Exhibit E-4), TS 36.213 (Exhibit E-5) and Ouchi (Exhibit E-7)) (the "LTE PUSCH-Hopping References"), in view of one or more references disclosing PUCCH frequency hopping (including at least TS 38.213 v15.1.0 (Exhibit E-1), Takeda (Exhibit E-6), Ouchi (Exhibit E-7), U.S. 9,762,357 ("Maattanen"), U.S. 10,873,435 ("Huang") (which is entitled to the priority date of its provisional), R1-1719015, and R1-1721380) (the "PUCCH-Hopping References"), and optionally one or more references disclosing the implementation of Bandwidth Part in 5G-NR (including at least 38.213 v15.1.0 (Exhibit E-1), Takeda (Exhibit E-6), U.S. 10,749,644 ("Islam"), U.S. 11,677,521 ("Kishiyama"), U.S. 11,677,528 ("Baldemair"), U.S. 2016/0381681 ("Nogami") and R1-1710878) (the "BWP References").

Multiple references (including at least the LTE PUSCH-Hopping References) disclose the use of PUSCH frequency hopping in LTE, including the procedures and algorithms used therein. Likewise, multiple references (including at least the PUCCH-Hopping References) separately disclose the use of PUCCH frequency hopping. Both PUCCH and PUSCH frequency hopping are intended to reduce the impact of frequency-specific interference, make interception more difficult, and take full advantage of the available bandwidth. Although PUSCH and PUCCH frequency hopping apply to different channels, they are commonly recognized as related procedures. For example, 38.213 discloses control channel procedures (including frequency hopping) while the very next specification (38.214) discloses comparably data channel procedures (including frequency hopping). These specifications were often updated in parallel. Likewise, references such as Ouchi recognize that the use of frequency hopping parameters applied to one physical channel (such as PUSCH) can also be applied to other physical channels (such as PUCCH). As such, a person of ordinary skill in the art would be motivated to combine references describing PUSCH frequency hopping and PUCCH frequency hopping.

Likewise, a person of ordinary skill in the art would be motivated to apply PUSCH and PUCCH frequency hopping procedures to both LTE system bandwidth and/or narrow bands, and 5G NR bandwidth part, as explained by the BWP References. Frequency hopping procedures (including those described in the LTE PUSCH-Hopping References and the PUCCH-Hopping References, and similar references) are typically designed to provide for hopping within a designated set of bandwidth, but the algorithms themselves are not dependent on whether that bandwidth is identified by way of carrier BWP, system bandwidth, narrowband, or other mechanisms. In each case, the bandwidth is defined by reference to specific resource blocks. For example, Baldemair explains that "bandwidth part comprises one or more resource blocks or

resource block groups, in particular one or more PRBs or PRB groups." Further, it is recognized that the purpose and concept of BWP is similar to LTE narrow band.[17] As such, a person of ordinary skill in the art would be motivated to apply PUSCH and PUCCH frequency hopping procedures to 5G NR bandwidth part, in further view of the BWP Reference

(7) Zhang in view of R1-1801080

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine Zhang charted in E-10 with R1-1801080 charted in E-11.

Zhang and R1-1801080 each seek to improve accuracy in UE resource allocation in 5G and propose to do so using frequency hopping with UE-specific Radio Resource Control ("RRC") signaling. R1-1801080 discloses issues relevant to frequency hopping in UL transmission in 5G. Further, R1-1801080 further describes BWP in terms of number of Physical Resource Blocks ("PRBs"). As Zhang and R1-1801080 both describe 5G frequency hopping using Bandwidth Parts ("BWP"), a person of ordinary skill in the art would be motivated to apply the teachings of R1-1801080 to Zhang.

For example, a POSITA would have understood R1-1801080's proposal confirming the value 50 as the boundary number of PRBs in the active UL BWP between bandwidths having two or four frequency offsets for frequency hopping on PUSCH to be consistent with the objectives of enhanced UE resource allocation accuracy disclosed in Zhang. R1-1801080's addition of the value 50 as the boundary number of PRBs in the active UL BWP would have been a routine addition to the fixed number of PRBs in the RBG at the edge of the BWP of Zhang. Enhancing Zhang's fixed

[17] *See, e.g.,* https://www.sharetechnote.com/html/5G/5G_CarrrierBandwidthPart.html.

number of PRBs in the RBG at the edge of the BWP with the specific value 50 as the boundary number of PRBs in the active UL BWP would have been an obvious way to improve the accuracy of the UE resource allocation in exactly the manner contemplated by Zhang. Thus, a person of ordinary skill in the art would be motivated to apply the teachings of R1-1801080 to Zhang.

(8) Shen in view of Matsumura

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine Shen charted in E-8 with Matsumura charted in E-9.

Shen and Matsumura seek to improve improving the transmission performance of the physical uplink channel in 5G communication systems by fully utilizing a larger bandwidth of the BWP to obtain a greater frequency selective gain and appropriately control an inter-slot frequency hopping pattern of each frequency resource to be hopped of an uplink channel or signal. *See* Shen at [0028], [0060]; Matsumura at [0008]. Both Shen and Matsumura improve the transmission performance of the physical uplink channel by implementing frequency hopping with UE-specific Radio Resource Control ("RRC") signaling. *See* Shen at [0037-38]; Matsumura at [0275-276]. Thus, a person of ordinary skill in the art would be motivated to apply the teachings of Matsumura to Shen.

For example, a POSITA would have understood Matsumura's intra-slot frequency hopping techniques of indicating an index of a PRB of a starting frequency resource, enabling frequency hopping of hopping frequency resources at a given timing of a slot for the PUCCH, and turning off the enabling (*e.g.*, disabling) of intra-slot frequency hopping for the slot when the number of available symbols in the certain slot is smaller than a given threshold X to be consistent with the disclosed objectives of enhanced transmission performance of the physical uplink channel by fully

utilizing a larger bandwidth of the BWP to obtain a greater frequency selective gain in Shen. Matsumura's addition of disabling frequency hopping when the number of available symbols in the certain slot is smaller than a given threshold would have been a routine addition to the frequency domain offset between two hops of frequency hopping that may be expressed by the number of Resource Blocks ("RB") of Shen. Enhancing Shen's use of the number of PRBs by utilizing a given threshold for the number of available symbols in the certain slot would have been an obvious way to improve the transmission performance of the physical uplink channel in exactly the manner contemplated by Shen. Such a modification would have been routine, and according to known methods, to obtain predictable results with a high probability of success. Thus, a person of ordinary skill in the art would be motivated to apply the teachings of Matsumura to Shen.

(9) Yin in view of 36.213 v14.2.0, in further view of 36.211 v11.6.0, (and, optionally) in further view of US Patent Publication No. 2013/0322493 ("Jersenius")

To the extent the references charted in Exhibits E-1–E-12 do not disclose every limitation of the '460 patent, it would have been obvious to combine Yin charted in E-11 with 36.213 v14.2.0 charted in Exhibit E-5 and 36.211 v11.6.0 (disclosures identified in Appendix E) and optionally with Jersenius (disclosures identified in Appendix E). It would have been obvious for a POSITA to turn to TS 36.211 and TS 36.213 for more information on configuring frequency hopping for PUSCH uplink resources. A POSITA would have been motivated to combine the PUSCH frequency hopping configuration methods described in these specifications with the PUCCH frequency hopping disclosed in Yin because 5G NR was implemented prior to the priority date of the '460 Patent while 4G LTE remained in use, and therefore a POSITA would have recognized benefits for 5G-capable UEs to continue to connect with 4G LTE BSs. In fact, Yin explicitly states

that "[a]t least some aspects of the systems and methods disclosed herein may be described in relation to the 3GPP LTE, LTE-Advanced (LTE-A) and other standards (*e.g.*, 3GPP Releases 8, 9, 10, 11 and/or 12)." Yin at ¶[0048]. Enhancing Yin's PUCCH frequency hopping with the PUSCH frequency hopping configuration methods described in TS 36.211 and TS 36.213 would have been an obvious way to improve the flexibility and/or efficiency of the UE resource allocation in exactly the manner contemplated by Yin.

A POSITA would have been further motivated to combine Yin and Jersenius to improve the transmission performance and flexibility of the physical uplink channel in 5G communication systems. As described above, a POSITA would be motivated to look to LTE concepts to inform 5G concepts. Specifically, a POSITA would be motivated to look to Jersenius, which discloses frequency hopping methods, to further inform the methods of Yin which also discloses frequency hopping methods. Similar to Yin, Jersenius also seeks to improve "efficiency" and describes similar components to Yin, including "subbands" and "Physical Resource Blocks."

(10) Additional References

To the extent the references charted in Exhibits E-1–E-12 do not disclose "[a] method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS)," or "[a] method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE)," it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose a method for a UE to transmit an uplink control channel and a UL data channel to a BS and a method for a BS to receive an UL control channel and an UL data channel from a UE. *See, e.g.*, Ex. E-1

TS 38.213 at 1[pre], 5[pre]; E-2 TS 38.214 at 1[pre], 5[pre]; E-3 Dahlman at 1[pre], 5[pre]; E4 Mehari at 1[pre], 5[pre]; E-5 TS 36.213 at 1[pre], 5[pre]; E-6 Takeda at 1[pre], 5[pre]; E-7 Ouchi at 1[pre], 5[pre]; E-8 Shen at 1[pre], 5[pre]; E-9 Matsumura at 1[pre], 5[pre]; E-10 Zhang at 1[pre], 5[pre]; and E-11 R1-1801080 at 1[pre], 5[pre]; E-12 Yin at 1[pre], 5[pre]. The '460 patent further admits that various methods were known in the art for a UE to transmit an uplink control channel and a UL data channel to a BS and a method for a BS to receive an UL control channel and an UL data channel from a UE ('460 patent at 4:28-34). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "[a] method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS)," or "[a] method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE)," it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a method

for a UE to transmit an uplink control channel and a UL data channel to a BS and a method for a BS to receive an UL control channel and an UL data channel from a UE. *See, e.g.*, Appendix E at 1[pre], 3[pre]. The '460 patent further admits that various methods were known in the art for a UE to transmit an uplink control channel and a UL data channel to a BS and a method for a BS to receive an UL control channel and an UL data channel from a UE ('460 patent at 4:28-34). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE," or "transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE," it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, from a BS, bandwidth part (BWP) configuration

information of a BWP set composed of one or more BWPs configured for a UE and transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE. *See, e.g.*, Ex. E-1 TS 38.213 at 1[a], 5[a]; E-2 TS 38.214 at 1[a], 5[a]; E-3 Dahlman at 1[a], 5[a]; E-4 Mehari at 1[a], 5[a]; E-5 TS 36.213 at 1[a], 5[a]; E-6 Takeda at 1[a], 5[a]; E7 Ouchi at 1[a], 5[a]; E-8 Shen at 1[a], 5[a]; E-9 Matsumura at 1[a], 5[a]; E-10 Zhang at 1[a], 5[a]; and E-11 R1-1801080 at 1[a], 5[a]; E-12 Yin at 1[a], 5[a]. The '460 patent further admits that various methods were known in the art for A person of skill in the art would be motivated to combine these references because the references all disclose receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE and transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more

BWPs configured for a UE," or "transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE," it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE and transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE. *See, e.g.*, Appendix E at 1[a], 5[a]. The '460 patent further admits that various methods were known in the art for a UE to transmit an uplink control channel and a UL data channel to a BS and a method for a BS to receive an UL control channel and an UL data channel from a UE ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data

channel transmitted through one transmission BWP of the BWP set," or "transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set and transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE. *See, e.g.*, Ex. E-1 TS 38.213 at 1[b], 5[b]; E-2 TS 38.214 at 1[b], 5[b]; E-3 Dahlman at 1[a], 5[b]; E-4 Mehari at 1[a], 5[b]; E-5 TS 36.213 at 1[b], 5[b]; E-6 Takeda at 1[b], 5[b]; E-11 Ouchi at 1[b], 5[b]; E-8 Shen at 1[b], 5[b]; E-9 Matsumura at 1[b], 5[b]; E-10 Zhang at 1[b], 5[b]; and E-11 R1-1801080 at 1[b], 5[b]; E-12 Yin at 1[b], 5[b]. The '460 patent further admits that various methods were known in the art for receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set and transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE ('460 patent at 7:29-7:36). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try

given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set," or "transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set and transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE. *See, e.g.*, Appendix E at 1[b], 5[b]. The '460 patent further admits that various methods were known in the art for receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set and transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE ('460 patent at 7:29-7:36). It is the nature of the communications field such as this to combine ideas from different references to achieve the

best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information," or "receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information and receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information. *See, e.g.*, Ex. E-1 TS 38.213 at 1[c], 5[c]; E-2 TS 38.214 at 1[c], 5[c]; E-3 Dahlman at 1[c], 5[c]; E-4 Mehari at 1[c], 5[c]; E-5 TS 36.213 at 1[c], 5[c]; E-6 Takeda at 1[c], 5[c]; E-7 Ouchi at 1[c], 5[c]; E-8

Shen at 1[c], 5[c]; E-9 Matsumura at 1[c], 5[c]; E-10 Zhang at 1[c], 5[c]; and E-11 R1-1801080 at 1[c], 5[c]; Yin at 1[c], 5[c].The '460 patent further admits that various methods were known in the art for transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information and receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information ('460 patent at 7:29-7:39). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information," or "receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation

as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information and receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information. *See, e.g.*, Appendix E at 1[c], 5[c]. The '460 patent further admits that various methods were known in the art for transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information and receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information ('460 patent at 7:29-7:39). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set

composed of one or more frequency hopping offset values" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values. *See, e.g.*, Ex. E-1 TS 38.213 at 1[d], 5[d], 9[c]; E-2 TS 38.214 at 1[d], 5[d], 9[c]; E-3 Dahlman at 1[d], 5[d], 9[c]; E-4 Mehari at 1[d], 5[d], 9[c]; E-5 TS 36.213 at 1[d], 5[d], 9[c]; E-6 Takeda at 1[d], 5[d], 9[c]; E-7 Ouchi at 1[d], 5[d], 9[c]; E-8 Shen at 1[d], 5[d], 9[c]; E-9 Matsumura at 1[d], 5[d], 9[c]; E-10 Zhang at 1[d], 5[d], 9[c]; and E-11 R1-1801080 at 1[d], 5[d], 9[c]; Yin at 1[d], 5[d], 9[c]. The '460 patent further admits that various methods were known in the art for frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values ('460 patent at 7:29-7:39). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values. *See, e.g.*, Appendix E at 1[d], 5[d], 9[c]. The '460 patent further admits that various methods were known in the art for frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values ('460 patent at 7:29-7:39). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset

values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI). *See, e.g.*, Ex. E-1 TS 38.213 at 1[e], 5[e], 9[d]; E-2 TS 38.214 at 1[e], 5[e], 9[d]; E-3 Dahlman at 1[e], 5[e], 9[d]; E-4 Mehari at 1[e], 5[e], 9[d]; E-5 TS 36.213 at 1[e], 5[e], 9[d]; E-6 Takeda at 1[e], 5[e], 9[d]; E-7 Ouchi at 1[e], 5[e], 9[d]; E-8 Shen at 1[e], 5[e], 9[d]; E-9 Matsumura at 1[e], 5[e], 9[d]; E-10 Zhang at 1[e], 5[e], 9[d]; and E-11 R1-1801080 at 1[e], 5[e], 9[d]; E-12 Yin at 1[e], 5[e], 9[d]. The '460 patent further admits that various methods were known in the art for a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI) ('460 patent at 7:29-7:39). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in

the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI). *See, e.g.*, Appendix E at 1[e], 5[e], 9[d]. The '460 patent further admits that various methods were known in the art for a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI) ('460 patent at 7:29-7:39). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in

the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "[a] user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS)" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose a user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS). *See, e.g.*, Ex. E-1 TS 38.213 at 9[pre]; E-2 TS 38.214 at 9[pre]; E-3 Dahlman at 9[pre]; E-4 Mehari at 9[pre]; E5 TS 36.213 at 9[pre]; E-6 Takeda at 9[pre]; E-7 Ouchi at 9[pre]; E-8 Shen at 9[pre]; E-9 Matsumura at 9[pre]; E-10 Zhang at 9[pre]; and E-11 R1-1801080 at 9[pre]; E-12 Yin at 9[pre]. The '460 patent further admits that various methods were known in the art for a user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS) ('460 patent at 3:38-47). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover,

these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "[a] user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS)" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS). *See, e.g.*, Appendix E at 9[pre]. The '460 patent further admits that various methods were known in the art for a user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS) ('460 patent at 3:38-47). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set

composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set. *See, e.g.*, Ex. E-1 TS 38.213 at 9[a]; E-2 TS 38.214 at 9[a]; E-3 Dahlman at 9[a]; E-4 Mehari at 9[a]; E-5 TS 36.213 at 9[a]; E-6 Takeda at 9[a]; E-7 Ouchi at 9[a]; E-8 Shen at 9[a]; E-9 Matsumura at 9[a]; E-10 Zhang at 9[a]; and E-11 R1-1801080 at 9[a]; E-12 Yin at 9[a]. The '460 patent further admits that various methods were known in the art for a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and

there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set. *See, e.g.*, Appendix E at 9[a]. The '460 patent further admits that various methods were known in the art for a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references,

and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information. *See, e.g.*, Ex. E-1 TS 38.213 at 9[b]; E-2 TS 38.214 at 9[b]; E-3 Dahlman at 9[b]; E-4 Mehari at 9[b]; E-5 TS 36.213 at 9[b]; E-6 Takeda at 9[b]; E-7 Ouchi at 9[b]; E-8 Shen at 9[b]; E-9 Matsumura at 9[b]; E-10 Zhang at 9[b]; and E-11 R1-1801080 at 9[b]; E-12 Yin at 9[b]. The '460 patent further admits that various methods were known in the art for a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information ('460 patent at 7:29-36). It is the nature of the communications field such as this to combine ideas

from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information. *See, e.g.*, Appendix E at 9[b]. The '460 patent further admits that various methods were known in the art for a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information ('460 patent at 7:29-36). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly,

a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel. *See, e.g.*, Ex. E-1 TS 38.213 at claims 2, 6, and 10; E-2 TS 38.214 at claims 2, 6, and 10; E-3 Dahlman at claims 2, 6, and 10; E-4 Mehari at claims 2, 6, and 10; E-5 TS 36.213 at claims 2, 6, and 10; E-6 Takeda at claims 2, 6, and 10; E-7 Ouchi at claims 2, 6, and

10; E-8 Shen at claims 2, 6, and 10; E-9 Matsumura at claims 2, 6, and 10; E-10 Zhang at claims 2, 6, and 10; and E-11 R1-1801080 at claims 2, 6, and 10; E-12 Yin at claims 2, 6, and 10. The '460 patent further admits that various methods were known in the art for the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references

charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel. *See, e.g.*, Appendix E at claims 2, 6, and 10. The '460 patent further admits that various methods were known in the art for the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a number of frequency hopping offset values included in the frequency hopping offset set is determined based

on a number of physical resource blocks (PRBs) constituting the transmission BWP" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP. *See, e.g.*, Ex. E-1 TS 38.213 at claims 3, 7, and 11; E-2 TS 38.214 at claims 3, 7, and 11; E-3 Dahlman at claims 3, 7, and 11; E-4 Mehari at claims 3, 7, and 11; E-5 TS 36.213 at claims 3, 7, and 11; E-6 Takeda at claims 3, 7, and 11; E-7 Ouchi at claims 3, 7, and 11; E-8 Shen at claims 3, 7, and 11; E-9 Matsumura at claims 3, 7, and 11; E-10 Zhang at claims 3, 7, and 11; and E-11 R1-1801080 at claims 3, 7, and 11; E-12 Yin at claims 3, 7, and 11. The '460 patent further admits that various methods were known in the art for a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have

been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP." it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP. *See, e.g.*, Appendix E at claims 3, 7, and 11. The '460 patent further admits that various methods were known in the art for a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP. ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying

known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the other references charted in Exhibits E-1–E-12, each of which discloses this limitation as shown in Exhibits E-1–E-12. A person of skill in the art would be motivated to combine these references because the references all disclose the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less. *See, e.g.*, Ex. E-1 TS 38.213 at claims 4, 8, and 12; E-2 TS 38.214 at claims 4, 8, and 12; E-3 Dahlman at claims 4, 8, and 12; E-4 Mehari at claims 4, 8, and 12; E-5 TS 36.213 at claims 4, 8, and 12; E-6 Takeda at claims 4, 8, and 12; E-7 Ouchi at claims 4, 8, and 12; E-8 Shen at claims 4, 8, and 12; E-9 Matsumura at claims 4, 8, and 12; E-10 Zhang at claims 4, 8, and 12; and E-11 R1-1801080 at claims 4, 8, and 12; E-12 Yin at claims 4, 8, and 12. The '460 patent further admits that various methods were known in the art for the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination

of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits E-1–E-12 do not disclose "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less" it would have been obvious to combine any of the references charted in Exhibits E-1–E-12 with any of the references charted in Appendix E, each of which discloses this limitation as shown in Appendix E. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less. *See, e.g.*, Appendix E at claims 4, 8, and 12. The '460 patent further admits that various methods were known in the art for the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less ('460 patent at 6:66-7:6). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified,

predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

f) Exemplary Motivation to Combine for the '118 Patent

(1) Yang in view of R2-141109

To the extent the references charted in Exhibits F-1–F-13 do not disclose every limitation of the '118 patent, it would have been obvious to combine Yang charted in Exhibit F-1 with R2-141109 charted in Exhibit F-4, each of which discloses every claim of the '118 patent as shown in F-1 and F-4. Both Yang and R2-141109 are in the same field of telecommunications and relate to the same functionality, specifically managing the dual connectivity of a device to both a master base station and a secondary base station. Further, both references discuss the use of radio resource control ("RRC") messages to manage the configuration of the device. Yang was filed on October 17, 2014 and R2-141109 was presented in March of 2014 at 3GPP TSG RAN WG2 meeting #85bis. Thus, both references originate from approximately the same time period. Additionally, Yang is assigned to the Electronics and Telecommunications Research Institute ("ETRI") and has been since the application was filed. R2-141109 was presented at 3GPP TSG RAN WG2 meeting #85bis, and ETRI was a participant at this meeting and made its own contributions. Thus, it would have been obvious to a POSITA to combine the teachings of both Yang and R2-141109 as they

were both related to the ongoing work prior to the earliest priority date of the '118 patent related to managing the dual connectivity of a device to both a master base station and a secondary base station and the use of radio resource control ("RRC") messages to manage the configuration of the device.

(2) Zhang in view of R2-141109

To the extent the references charted in Exhibits F-1–F-13 do not disclose every limitation of the '118 patent, it would have been obvious to combine Zhang charted in Exhibit F-2 with R2-141109 charted in Exhibit F-4, each of which discloses every claim of the '118 patent as shown in F-1 and F-4. Both Zhang and R2-141109 are in the same field of telecommunications and relate to the same functionality, specifically implementing a dual-connectivity system for a user terminal. Further, both references discuss the use of radio resource control ("RRC") messages to manage the configuration of the user terminal. Zhang was filed on November 15, 2013 and R2-141109 was presented in March of 2014 at 3GPP TSG RAN WG2 meeting #85bis. Thus, both references originate from approximately the same time period. Additionally, Zhang is assigned to the Huawei Technologies Co., Ltd. And has been since the application was filed. R2-141109 was presented at 3GPP TSG RAN WG2 meeting #85bis, and Huawei Technologies Co., Ltd. Was a participant at this meeting and made its own contributions. Thus, it would have been obvious to a POSITA to combine the teachings of both Zhang and R2-141109 as they were both related to the ongoing work prior to the earliest priority date of the '118 patent related to implementing a dual-connectivity system for a user terminal and a secondary base station and the use of radio resource control ("RRC") messages to manage the configuration of the device.

(3) Takahashi in view of R2-141109

To the extent the references charted in Exhibits F-1–F-13 do not disclose every limitation of the '118 patent, it would have been obvious to combine Takahashi charted in Exhibit F-3 with R2-141109 charted in Exhibit F-4, each of which discloses every claim of the '118 patent as shown in F-1 and F-4. Both Takahashi and R2-141109 are in the same field of telecommunications and relate to the same functionality, specifically managing the dual connectivity of a user equipment to a master base station and a secondary base station. Further, both references discuss the use of radio resource control ("RRC") messages to manage the configuration of the user terminal. Takahashi was filed on September 25, 2014 and claims priority to a Japanese application filed on September 26, 2013. R2-141109 was presented in March of 2014 at 3GPP TSG RAN WG2 meeting #85bis. Thus, both references originate from approximately the same time period. Additionally, Takahashi is assigned to the NTT Docomo, Inc. and has been since the application was filed. R2-141109 was presented at 3GPP TSG RAN WG2 meeting #85bis, and NTT Docomo, Inc. was a participant at this meeting and made its own contributions. Indeed, all three of the named inventors participated at 3GPP TSG RAN WG2 meeting #85bis. Thus, it would have been obvious to a POSITA to combine the teachings of both Takahashi and R2-141109 as they were both related to the ongoing work prior to the earliest priority date of the '118 patent related to managing the dual connectivity of a user equipment to a master base station and a secondary base station and the use of radio resource control ("RRC") messages to manage the configuration of the device.

(4) Futaki in view of 3GPP TS 36.300 version 12.8.0

To the extent the references charted in Exhibits F-1–F-13 do not disclose every limitation of the '118 patent, it would have been obvious to combine Futaki charted in Exhibit F-13 with the disclosures of 3GPP TS 36.300 version 12.8.0 identified in Appendix F. Both Futaki and 3GPP

TS 36.300 version 12.8.0 are in the same field of telecommunications and relate to the same functionality, specifically managing the dual connectivity of a user equipment to a master base station and a secondary base station. Further, both references discuss the use of radio resource control ("RRC") messages to manage the configuration of the user terminal. Futaki was filed on December 14, 2016 and claims priority to a Japanese application filed on January 8, 2016. 3GPP TS 36.300 version 12.8.0 was published on January 4, 2016. Thus, both references originate from the same time period. Additionally, Futaki is assigned to the NEC Corporation and has been since the application was filed. 3GPP TS 36.300 version 12.8.0 arose out of 3GPP RAN meeting #70, and NEC Corporation was a participant at this meeting and made its own contributions. Thus, it would have been obvious to a POSITA to combine the teachings of both Futaki and 3GPP TS 36.300 version 12.8.0 as they were both related to the ongoing work prior to the earliest priority date of the '118 patent related to managing the dual connectivity of a user equipment to a master base station and a secondary base station and the use of radio resource control ("RRC") messages to manage the configuration of the device.

(5) Additional References

To the extent the references charted in Exhibits F-1–F-13 do not disclose "[a] method of a user equipment for configuring dual connectivity," "[a] method of a secondary base station for controlling dual connectivity of a user equipment," or "[a] user equipment for configuring dual connectivity," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1–F-13 . A person of skill in the art would be motivated to combine these references because the references all disclose a method of a user equipment for configuring dual connectivity, a method of a secondary base station for controlling dual

connectivity of a user equipment, and a user equipment for configuring dual connectivity. *See, e.g.*, Ex. F-1 ("Yang") at 1[pre], 7[pre], 10[pre]; Ex. F-2 ("Zhang") at 1[pre], 7[pre], 10[pre]; Ex. F-3 ("Takahashi") at 1[pre], 7[pre], 10[pre]; Ex. F-4 ("R2-141109") at 1[pre], 7[pre], 10[pre]; Ex. F-5 ("Wu") at 1[pre], 7[pre], 10[pre]; Ex. F-6 ("Heo") at 1[pre], 7[pre], 10[pre]; Ex. F-7 ("Velde") at 1[pre], 7[pre], 10[pre]; Ex. F-8 ("Sharma") at 1[pre], 7[pre], 10[pre]; Ex. F-9 ("Parkvall") at 1[pre], 7[pre], 10[pre]; Ex. F-10 ("R2-133392") at 1[pre], 7[pre], 10[pre]; Ex. F-11 ("R2-140059") at 1[pre], 7[pre], 10[pre]; Ex. F-12 ("R2-144867") at 1[pre], 7[pre], 10[pre]; Ex. F-13 ("Futaki") at 1[pre], 7[pre], 10[pre]. The '118 patent further admits that various methods were known in the art for configuring dual connectivity of a user equipment ('118 patent at 1:29-2:5, 6:44-49, 8:22-30). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "[a] method of a user equipment for configuring dual connectivity," "[a] method of a secondary base station for controlling dual connectivity of a user equipment," or "[a] user equipment for configuring dual connectivity," it would have been obvious to combine any of the references charted in Exhibits F-

1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose a method of a user equipment for configuring dual connectivity, a method of a secondary base station for controlling dual connectivity of a user equipment, and a user equipment for configuring dual connectivity. *See, e.g.*, Appendix F at 1[pre], 7[pre], 10[pre]. The '118 patent further admits that various methods were known in the art for configuring dual connectivity of a user equipment ('118 patent at 1:29-2:5, 6:44-49, 8:22-30). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "adding and configuring a secondary base station signaling radio bearer (SRB)," "determining, by the secondary base station, to add a secondary base station signaling radio bearer (SRB) to the user equipment," or "a controller configured to add and configure a secondary base station signaling radio bearer (SRB)," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which

discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose adding and configuring a secondary base station signaling radio bearer, determining, by the secondary base station, to add a secondary base station signaling radio bearer to the user equipment, and a controller configured to add and configure a secondary base station signaling radio bearer. *See, e.g.*, Ex. F-1 ("Yang") at 1[a], 7[a], 10[a]; Ex. F-2 ("Zhang") at 1[a], 7[a], 10[a]; Ex. F-3 ("Takahashi") at 1[a], 7[a], 10[a]; Ex. F-4 ("R2-141109") at 1[a], 7[a], 10[a]; Ex. F-5 ("Wu") at 1[a], 7[a], 10[a]; Ex. F-6 ("Heo") at 1[a], 7[a], 10[a]; Ex. F-7 ("Velde") at 1[a], 7[a], 10[a]; Ex. F-8 ("Sharma") at 1[a], 7[a], 10[a]; Ex. F-9 ("Parkvall") at 1[a], 7[a], 10[a]; Ex. F-10 ("R2-133392") at 1[a], 7[a], 10[a]; Ex. F-11 ("R2-140059") at 1[a], 7[a], 10[a]; Ex. F-12 ("R2-144867") at 1[a], 7[a], 10[a]; Ex. F-13 ("Futaki") at 1[a], 7[a], 10[a]. The '118 patent further admits that various methods were known in the art for adding and configuring a secondary base station signaling radio bearer ('118 patent at 1:29-2:5, 3:29-31, 6:60-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "adding and configuring a secondary base station signaling radio bearer (SRB)," "determining, by the secondary base station, to add a secondary base station signaling radio bearer (SRB) to the user equipment," or "a controller configured to add and configure a secondary base station signaling radio bearer (SRB)," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose adding and configuring a secondary base station signaling radio bearer, determining, by the secondary base station, to add a secondary base station signaling radio bearer to the user equipment, and a controller configured to add and configure a secondary base station signaling radio bearer. *See, e.g.*, Appendix F at 1[a], 7[a], 10[a]. The '118 patent further admits that various methods were known in the art for adding and configuring a secondary base station signaling radio bearer ('118 patent at 1:29-2:5, 3:29-31, 6:60-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB," "transmitting a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group to the user equipment through the secondary base station SRB," or "a receiver configured to receive from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB, transmitting a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group to the user equipment through the secondary base station SRB, and a receiver configured to receive from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB. *See, e.g.*, Ex. F-1 ("Yang") at 1[b], 7[b], 10[b]; Ex. F-2 ("Zhang") at 1[b], 7[b], 10[b]; Ex. F-3 ("Takahashi") at 1[b], 7[b], 10[b]; Ex. F-4 ("R2-141109") at 1[b], 7[b], 10[b]; Ex. F-5 ("Wu") at 1[b], 7[b], 10[b]; Ex. F-6 ("Heo") at 1[b], 7[b], 10[b]; Ex. F-7 ("Velde") at 1[b], 7[b], 10[b]; Ex. F-8 ("Sharma") at 1[b], 7[b], 10[b]; Ex. F-9 ("Parkvall") at 1[b],

7[b], 10[b]; Ex. F-10 ("R2-133392") at 1[b], 7[b], 10[b]; Ex. F-11 ("R2-140059") at 1[b], 7[b], 10[b]; Ex. F-12 ("R2-144867") at 1[b], 7[b], 10[b]; Ex. F-13 ("Futaki") at 1[b], 7[b], 10[b]. The '118 patent further admits that various methods were known in the art for receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB," "transmitting a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group to the user equipment through the secondary base station SRB," or "a receiver configured to receive from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through

the secondary base station SRB," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB, transmitting a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group to the user equipment through the secondary base station SRB, and a receiver configured to receive from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB. *See, e.g.*, Appendix F at 1[b], 7[b], 10[b]. The '118 patent further admits that various methods were known in the art for receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations

would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message," "wherein, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station," or "a transmitter configured to transmit a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station, and a transmitter configured to transmit a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message. *See, e.g.*, Ex. F-1 ("Yang") at 1[c], 9, 10[c]; Ex. F-2 ("Zhang") at 1[c], 9, 10[c]; Ex. F-3 ("Takahashi") at 1[c], 9, 10[c]; Ex. F-4 ("R2-141109") at 1[c], 9, 10[c]; Ex. F-5 ("Wu") at 1[c], 9, 10[c]; Ex. F-6 ("Heo") at 1[c], 9, 10[c]; Ex. F-7 ("Velde") at 1[c], 9, 10[c]; Ex. F-8 ("Sharma") at 1[c], 9, 10[c];

Ex. F-9 ("Parkvall") at 1[c], 9, 10[c]; Ex. F-10 ("R2-133392") at 1[c], 9, 10[c]; Ex. F-11 ("R2-140059") at 1[c], 9, 10[c]; Ex. F-12 ("R2-144867") at 1[c], 9, 10[c]; Ex. F-13 ("Futaki") at 1[c], 7[c], 10[c]. The '118 patent further admits that various methods were known in the art for transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message," "wherein, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station," or "a transmitter configured to transmit a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message," it would have been obvious to

combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station, and a transmitter configured to transmit a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message. *See, e.g.*, Appendix F at 1[c], 9, 10[c]. The '118 patent further admits that various methods were known in the art for transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the addition of the secondary base station SRB is determined by the secondary base station," "wherein the user equipment configures dual connectivity by using a master base station and the secondary base station," or "wherein the addition of the secondary base station SRB is determined by the secondary base station," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose the addition of the secondary base station SRB is determined by the secondary base station, the user equipment configures dual connectivity by using a master base station and the secondary base station, and the addition of the secondary base station SRB is determined by the secondary base station. *See, e.g.*, Ex. F-1 ("Yang") at 1[d], 7[d], 10[d]; Ex. F-2 ("Zhang") at 1[d], 7[d], 10[d]; Ex. F-3 ("Takahashi") at 1[d], 7[d], 10[d]; Ex. F-4 ("R2-141109") at 1[d], 7[d], 10[d]; Ex. F-5 ("Wu") at 1[d], 7[d], 10[d]; Ex. F-6 ("Heo") at 1[d], 7[d], 10[d]; Ex. F-7 ("Velde") at 1[d], 7[d], 10[d]; Ex. F-8 ("Sharma") at 1[d], 7[d], 10[d]; Ex. F-9 ("Parkvall") at 1[d], 7[d], 10[d]; Ex. F-10 ("R2-133392") at 1[d], 7[d], 10[d]; Ex. F-11 ("R2-140059") at 1[d], 7[d], 10[d]; Ex. F-12 ("R2-144867") at 1[d], 7[d], 10[d]; Ex. F-13 ("Futaki") at 1[d], 7[d], 10[d]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable

expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the addition of the secondary base station SRB is determined by the secondary base station," "wherein the user equipment configures dual connectivity by using a master base station and the secondary base station," or "wherein the addition of the secondary base station SRB is determined by the secondary base station," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose the addition of the secondary base station SRB is determined by the secondary base station, the user equipment configures dual connectivity by using a master base station and the secondary base station, and the addition of the secondary base station SRB is determined by the secondary base station. *See, e.g.*, Appendix F at 1[d], 7[d], 10[d]. It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying

known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the master base station and the second base station are base stations using radio access technologies different from each other," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose the master base station and the second base station are base stations using radio access technologies different from each other. *See, e.g.*, Ex. F-1 ("Yang") at 2, 8, 11; Ex. F-2 ("Zhang") at 2, 8, 11; Ex. F-3 ("Takahashi") at 2, 8, 11; Ex. F-4 ("R2-141109") at 2, 8, 11; Ex. F-5 ("Wu") at 2, 8, 11; Ex. F-6 ("Heo") at 2, 8, 11; Ex. F-7 ("Velde") at 2, 8, 11; Ex. F-8 ("Sharma") at 2, 8, 11; Ex. F-9 ("Parkvall") at 2, 8, 11; Ex. F-10 ("R2-133392") at 2, 8, 11; Ex. F-11 ("R2-140059") at 2, 8, 11; Ex. F-12 ("R2-144867") at 2, 8, 11; Ex. F-13 ("Futaki") at 2, 8, 11. The '118 patent further admits that various methods were known in the art for the master base station and the second base station are base stations using radio access technologies different from each other ('118 patent at 1:29-2:5, 7:64-35). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from

prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the master base station and the second base station are base stations using radio access technologies different from each other," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose the master base station and the second base station are base stations using radio access technologies different from each other. *See, e.g.*, Appendix F at 2, 8, 11. The '118 patent further admits that various methods were known in the art for the master base station and the second base station are base stations using radio access technologies different from each other ('118 patent at 1:29-2:5, 7:64-35). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure. *See, e.g.*, Ex. F-1 ("Yang") at 3, 12; Ex. F-2 ("Zhang") at 3, 12; Ex. F-3 ("Takahashi") at 3, 12; Ex. F-4 ("R2-141109") at 3, 12; Ex. F-5 ("Wu") at 3, 12; Ex. F-6 ("Heo") at 3, 12; Ex. F-7 ("Velde") at 3, 12; Ex. F-8 ("Sharma") at 3, 12; Ex. F-9 ("Parkvall") at 3, 12; Ex. F-10 ("R2-133392") at 3, 12; Ex. F-11 ("R2-140059") at 3, 12; Ex. F-12 ("R2-144867") at 3, 12; Ex. F-13 ("Futaki") at 3, 12. The '118 patent further admits that various methods were known in the art for the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure ('118 patent at 1:29-2:5, 3:29-31, 6:60-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations

would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure. *See, e.g.*, Appendix F at 3, 12. The '118 patent further admits that various methods were known in the art for the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure ('118 patent at 1:29-2:5, 3:29-31, 6:60-61). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended. *See, e.g.*, Ex. F-1 ("Yang") at 4, 13; Ex. F-2 ("Zhang") at 4, 13; Ex. F-3 ("Takahashi") at 4, 13; Ex. F-4 ("R2-141109") at 4, 13; Ex. F-5 ("Wu") at 4, 13; Ex. F-6 ("Heo") at 4, 13; Ex. F-7 ("Velde") at 4, 13; Ex. F-8 ("Sharma") at 4, 13; Ex. F-9 ("Parkvall") at 4, 13; Ex. F-10 ("R2-133392") at 4, 13; Ex. F-11 ("R2-140059") at 4, 13; Ex. F-12 ("R2-144867") at 4, 13; Ex. F-13 ("Futaki") at 4, 13. The '118 patent further admits that various methods were known in the art for in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements

according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein, in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended. *See, e.g.*, Appendix F at 4, 13. The '118 patent further admits that various methods were known in the art for in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message and therefore fails to a secondary BS radio resource configuration, a radio resource on the secondary base station or the secondary cell group is suspended ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and

complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the radio resource on the secondary base station or the secondary cell group includes at least one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose the radio resource on the secondary base station or the secondary cell group includes at least one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB. *See, e.g.*, Ex. F-1 ("Yang") at 5, 14; Ex. F-2 ("Zhang") at 5, 14; Ex. F-3 ("Takahashi") at 5, 14; Ex. F-4 ("R2-141109") at 5, 14; Ex. F-5 ("Wu") at 5, 14; Ex. F-6 ("Heo") at 5, 14; Ex. F-7 ("Velde") at 5, 14; Ex. F-8 ("Sharma") at 5, 14; Ex. F-9 ("Parkvall") at 5, 14; Ex. F-10 ("R2-133392") at 5, 14; Ex. F-11 ("R2-140059") at 5, 14; Ex. F-12 ("R2-144867") at 5, 14; Ex. F-13 ("Futaki") at 5, 14. The '118 patent further admits that various methods were known in the art for the radio resource on the secondary base station or the secondary cell group includes at least one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part

of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB ('118 patent at 1:29-2:5, 6:60-7:63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the radio resource on the secondary base station or the secondary cell group includes at least one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose the radio resource on the secondary base station or the secondary cell group includes at least one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB. *See, e.g.*, Appendix F at 5, 14. The '118 patent further admits that various methods were known in the art for the radio resource on the secondary base station or the secondary cell group includes at least

one of a secondary cell group data radio bearer (DRB), a secondary cell group SRB, a part of a secondary cell group of a split DRB, and a part of a secondary cell group of a split SRB ('118 patent at 1:29-2:5, 6:60-7:63). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the failure information message includes cause information on the secondary base station radio resource configuration failure," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose the failure information message includes cause information on the secondary base station radio resource configuration failure. *See, e.g.*, Ex. F-1 ("Yang") at 6, 15; Ex. F-2 ("Zhang") at 6, 15; Ex. F-3 ("Takahashi") at 6, 15; Ex. F-4 ("R2-141109") at 6, 15; Ex. F-5 ("Wu") at 6, 15; Ex. F-6 ("Heo") at 6, 15; Ex. F-7 ("Velde") at 6, 15; Ex. F-8 ("Sharma") at 6, 15; Ex. F-9 ("Parkvall") at 6, 15; Ex. F-10 ("R2-133392") at 6, 15; Ex. F-11 ("R2-140059") at 6, 15; Ex. F-12 ("R2-144867") at 6,

15; Ex. F-13 ("Futaki") at 6, 15. The '118 patent further admits that various methods were known in the art for the failure information message includes cause information on the secondary base station radio resource configuration failure ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "wherein the failure information message includes cause information on the secondary base station radio resource configuration failure," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose the failure information message includes cause information on the secondary base station radio resource configuration failure. *See, e.g.*, Appendix F at 6, 15. The '118 patent further admits that various methods were known in the art for the failure information message includes cause information on the secondary base station radio resource configuration failure ('118 patent at 1:29-2:5, 7:18-38). It is the nature of the communications field such as this to combine ideas from different references to achieve the best

solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the other references charted in Exhibits F-1–F-13, each of which discloses this limitation as shown in Exhibits F-1-F-13. A person of skill in the art would be motivated to combine these references because the references all disclose receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station. *See, e.g.*, Ex. F-1 ("Yang") at 7[c]; Ex. F-2 ("Zhang") at 7[c]; Ex. F-3 ("Takahashi") at 7[c]; Ex. F-4 ("R2-141109") at 7[c]; Ex. F-5 ("Wu") at 7[c]; Ex. F-6 ("Heo") at 7[c]; Ex. F-7 ("Velde") at 7[c]; Ex. F-8 ("Sharma") at 7[c]; Ex. F-9 ("Parkvall") at 7[c]; Ex. F-10 ("R2-133392") at 7[c]; Ex. F-11 ("R2-140059") at 7[c]; Ex. F-12 ("R2-144867") at 7[c]; Ex. F-13 ("Futaki") at 7[c]. The '118 patent further admits that various methods were known in the art for receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE

successfully complies with a radio resource on the secondary base station ('118 patent at 1:29-2:5, 7:23-25). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits F-1–F-13 do not disclose "receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station," it would have been obvious to combine any of the references charted in Exhibits F-1–F-13 with any of the references charted in Appendix F, each of which discloses this limitation as shown in Appendix F. A person of skill in the art would be motivated to combine these references because the references all disclose receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station. *See, e.g.*, Appendix F at 7[c]. The '118 patent further admits that various methods were known in the art for receiving a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station ('118 patent at 1:29-2:5,

7:23-25). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

g) Exemplary Motivation to Combine for the ’000 Patent

(1) Yan in view of Takeda III

To the extent the references charted in Exhibits G-1–G-16 do not disclose every limitation of the ’000 patent, it would have been obvious to combine Yan, charted in Exhibit G-9, with Takeda III, charted in Exhibit G-8, each of which discloses every claim of the ’000 patent as shown in G-9 and G-8. Both Yan and Takeda III are in the same technical field related to the efficient transmission of UCI. More particularly, Yan is directed towards allocating resources for the transmission of UCI in a manner that reduces overall resource consumption. Similarly, Takeda III is directed towards activating/deactivating UL BWPs for transmitting UCI in a manner that reduces

a processing load at a user terminal. Moreover, Yan and Takeda III disclose similar methods for transmitting UCI. For example, both Yan and Takeda III disclose receiving resource set configuration information, determining a resource set from the configuration information, determining a resource within the resource set based on DCI, and transmitting UCI in the determined resource. As both Yan and Takeda III relate to similar fields and describe similar functionality, a person having ordinary skill in the art would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Yan related to resource allocation for UCI transmission with the BWP-specific teachings of Takeda III. Further, a person having ordinary skill in the art would have been motivated to modify Takeda III with the teachings of Yan to provide Takeda III with backwards network compatibility and to incorporate Yan's methods for conserving UE power by strategically allocating UL channel resources into Takeda III's methods for transmitting UL signals within BWPs.

(2) Yan in view of R1-1711853

To the extent the references charted in Exhibits G-1–G-16 do not disclose every limitation of the '000 patent, it would have been obvious to combine Yan, charted in Exhibit G-9, with R1-1711853, charted in Exhibit G-15, each of which discloses every claim of the '000 patent as shown in G-9 and G-15. A person having ordinary skill in the art would have been motivated to use BWPs (as discussed in R1-1711853) with Yan's resource allocation methodology, to provide efficient use of power resources of the UE. Specifically, a person having ordinary skill in the art would have recognized that the use of BWPs provides improved power efficiency for the UE during UL transmission, because the UE only transmits over a subset of a carrier frequency band. Using 5G NR BWPs as discussed in R1-1711853 would have provided further power conservation for UEs operating with Yan's resource allocation methodology, that discusses power conservation by

selecting UL resources that are optimal for the size/type of UCI to be transmitted by the UE. A person having ordinary skill in the art would have a reasonable expectation of success in adapting Yan's UL resource allocation methods for BWPs, because Yan's resource allocation method is usable to allocate resources in the frequency domain and would be similarly usable with frequency bands defining BWPs. Moreover, R1-1711853 discloses that BWPs are activated "by means of DCI," which may include a grant of an UL resource configured for the BWP to be activated. A person having ordinary skill in the art would recognize that the "grant" in R1-1711853 is equivalent to the channel indication information discussed in Yan, and therefore Yan's channel indication information is already capable of activating an individual BWP in the manner discussed in R1-1711853. Thus, a person having ordinary skill in the art would have had a reasonable expectation of success in applying the BWPs and BWP activation method of R1-1711853 to Yan.

(3) Marinier in view of Yan and R1-1711853

To the extent the references charted in Exhibits G-1–G-16 do not disclose every limitation of the '000 patent, it would have been obvious to combine Mariner, charted in Exhibit G-3, with Yan, charted in Exhibit G-9, and R1-1711853, charted in Exhibit G-15, each of which discloses every claim of the '000 patent as shown in G-3, G-9, and G-15. A person having ordinary skill in the art would have been motivated to modify Marinier's methods for transmitting UL signals to incorporate Yan's methods for allocating UL channel resources to determine the most efficient UL channel resource based on a size of the UCI. Yan explains that the capacity of UL channel resources specified by a BS may be underutilized, or UCI bits may be discarded if the size of the UL channel does not meet the size of UCI. This mismatch of UL channel resource size and UCI size is applicable for Marinier's BWP-based UL signaling configuration. Therefore, a person having ordinary skill in the art would have incorporated Yan's resource allocation methodology

of determining an UL channel resource set based on UCI size to efficiently utilize Marinier's UL channel resources and to conserve UE power during UL signaling. Using Yan's resource allocation methodology within UL BWPs of Marinier would ensure that UCI bits are not discarded and minimizes UL resource consumption by UEs during UL transmission. Further, Marinier and Yan both discuss UCI transmission and resource allocation for transmitting UCI. Moreover, Marinier discusses that PUCCH parameters usable in specific BWPs are received from the BS, including "preconfigured set[s] of parameters" that define dedicated PUCCH resources control UL transmissions. Yan discloses analogous features for determining a channel resource for UL signaling from resource sets included in configuration information from a BS. Therefore, a person having ordinary skill in the art would have recognized that Marinier's methods for selecting a "preconfigured set of parameters" for UL transmission would be adaptable to utilize Yan's configuration information received from the BS, for example so that the UE can determine an UL resource using the configuration information. Similarly, a person having ordinary skill in the art would have been motivated to modify the UL signaling method as taught by Marinier and Yan with the teachings of R1-1711853 to incorporate the BWP activation protocol proposed in R1-1711853 to achieve improved power efficiency when transmitting UL signals from a UE using 5G NR. Marinier explains that its resource allocation methods provide power efficiency by selecting optimal UL resources for UCI. Incorporating 5G NR's BWPs and methods of activating those BWPs would further Marinier's stated goal of conserving UE power because 5G NR BWPs allow UEs to transmit on a portion of the carrier frequency band, instead of the entire carrier frequency band.

(4) Ahn in view of Takeda III

To the extent the references charted in Exhibits G-1–G-16 do not disclose every limitation of the '000 patent, it would have been obvious to combine Takeda III, charted in Exhibit G-8, with Ahn, charted in Exhibit G-1, each of which discloses every claim of the '000 patent as shown in G-8 and G-1. Both Takeda III and Ahn are in the same technical field related to improved communications in LTE-A and NR systems. Moreover, both Takeda III and Ahn describe the need for greater bandwidth flexibility in LTE-A and NR systems, such as through techniques including carrier aggregation and bandwidth parts (BWPs). More particularly, Takeda III is directed towards enabling activation/deactivation of one or more DL and/or UL BWPs for the reception of DCI and transmission of UCI based on the received DCI. Similarly, Ahn is directed towards a method for transmitting UCI through a PUCCH resource indicated or allocated by DCI. As both Takeda III and Ahn relate to similar functionality, a POSITA would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Ahn related to transmitting UCI on a resource allocated by DCI with the BWP-specific teachings of Takeda.

(5) Ahn in view of R1-1709802 and R1-1714079

To the extent the references charted in Exhibits G-1–G-16 do not disclose every limitation of the '000 patent, it would have been obvious to combine Ahn, charted in Exhibit G-1, with R1-1709802 and R1-1714079, charted in Exhibits G-12 and G-13, respectively, which disclose every claim of the '000 patent as shown in G-1, G-12, and G-14. Ahn, R1-1709802, and R1-1714079 are in the same technical field related to configuring and allocating resources for efficient DL and UL transmissions in LTE-A and NR systems. More particularly, Ahn is directed towards a method for transmitting UCI through a PUCCH resource/format indicated by DCI. Similarly, R1-1714079

is a 3GPP proposal directed towards PUCCH resource allocation for UCI transmission in NR, including proposals for configuring multiple PUCCH resource sets, selecting a resource set from the multiple PUCCH resource sets, and using DCI to select a resource from the selected resource set for UCI transmission. Similarly, R1-1709802 is a 3GPP proposal directed to using BWPs for efficient wideband operation in NR. R1-1709802 discloses that each BWP configurations include at least one control resource set (CORESET) and that an active DL/UL BWP may be indicated by DCI. As Ahn, R1-1714079, and R1-1709802 each relate to configuring and allocating resources for efficient DL and UL transmissions in LTE-A and NR systems, a POSITA would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Ahn and R1-1714079 related to configuring and allocating resources for UCI transmission with the BWP-specific teachings of R1-1709802. Moreover, it would have been obvious to combine R1-1714079 and R1-1709802 because both are 3GPP proposals that describe configuring PUCCH resources and BWPs for efficient operation in NR.

(6) Additional References

To the extent the references charted in Exhibits G-1–G-16 do not disclose "[a] method of transmitting uplink (UL) control information by a user equipment (UE)," "[a] method of receiving uplink (UL) control information by a base station," or "[a] user equipment (UE) for transmitting uplink (UL) control information," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 1[pre], 5[pre], 9[pre]; Ex. G-2 ("LI") at 1[pre], 5[pre], 9[pre]; Ex. G-

3 ("Marinier") at 1[pre], 5[pre], 9[pre]; Ex. G-4 ("Nayeb Nazar") at 1[pre], 5[pre], 9[pre]; Ex. G-5 ("Shaheen") at 1[pre], 5[pre], 9[pre]; Ex. G-6 ("Takeda I") at 1[pre], 5[pre], 9[pre]; Ex. G-7 ("Takeda II") at 1[pre], 5[pre], 9[pre]; Ex. G-8 ("Takeda III") at 1[pre], 5[pre], 9[pre]; Ex. G-9 ("Yan") at 1[pre], 5[pre], 9[pre]; Ex. G-10 ("Yang") at 1[pre], 5[pre], 9[pre]; Ex. G-11 ("Zhang") at 1[pre], 5[pre], 9[pre]; Ex. G-12 ("R1-1709802") at 1[pre], 5[pre], 9[pre]; Ex. G-13 ("R1-1713181") at 1[pre], 5[pre], 9[pre]; Ex. G-14 ("R1-1714079") at 1[pre], 5[pre], 9[pre]; G-16 ("Oh") at 1[pre], 5[pre], 9[pre]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('000 patent at 7:41-48, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "receiving, from a base station, UL control channel resource set configuration information for UL control information transmission," "transmitting, to a user equipment (UE), UL control channel resource set configuration information for UL control information," or "a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control

information transmission," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 1[a], 5[a], 9[a]; Ex. G-2 ("LI") at 1[a], 5[a], 9[a]; Ex. G-3 ("Marinier") at 1[a], 5[a], 9[a]; Ex. G-4 ("Nayeb Nazar") at 1[a], 5[a], 9[a]; Ex. G-5 ("Shaheen") at 1[a], 5[a], 9[a]; Ex. G-6 ("Takeda I") at 1[a], 5[a], 9[a]; Ex. G-7 ("Takeda II") at 1[a], 5[a], 9[a]; Ex. G-8 ("Takeda III") at 1[a], 5[a], 9[a]; Ex. G-9 ("Yan") at 1[a], 5[a], 9[a]; Ex. G-10 ("Yang") at 1[a], 5[a], 9[a]; Ex. G-11 ("Zhang") at 1[a], 5[a], 9[a]; Ex. G-12 ("R1-1709802") at 1[a], 5[a], 9[a]; Ex. G-13 ("R1-1713181") at 1[a], 5[a], 9[a]; Ex. G-14 ("R1-1714079") at 1[a], 5[a], 9[a]; G-16 ("Oh") at 1[a], 5[a], 9[a]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('000 patent at 7:41-48, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "determining one of UL control channel resource sets contained in the received UL control channel resource set configuration information," or "a controller configured to determine one of UL control channel resource sets contained in the received UL control channel resource set configuration information," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 1[b], 9[b]; Ex. G-2 ("LI") at 1[b], 9[b]; Ex. G-3 ("Marinier") at 1[b], 9[b]; Ex. G-4 ("Nayeb Nazar") at 1[b], 9[b]; Ex. G-5 ("Shaheen") at 1[b], 9[b]; Ex. G-6 ("Takeda I") at 1[b], 9[b] Ex. G-7 ("Takeda II") at 1[b], 9[b]; Ex. G-8 ("Takeda III") at 1[b], 9[b]; Ex. G-9 ("Yan") at 1[b], 9[b]; Ex. G-10 ("Yang") at 1[b], 9[b]; Ex. G-11 ("Zhang") at 1[b], 9[b]; Ex. G-12 ("R1-1709802") at 1[b], 9[b]; Ex. G-13 ("R1-1713181") at 1[b], 9[b]; Ex. G-14 ("R1-1714079") at 1[b], 9[b]; G-16 ("Oh") at 1[b], 9[b]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('000 patent at 7:41-48, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from

prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "determining one of UL control channel resources contained in the determined UL control channel resource set," or "a controller configured to determine . . . one of UL control channel resources configuring the determined one UL control channel resource set," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data using an uplink or downlink resource. *See, e.g.*, Ex. G-1 ("Ahn") at 1[c], 9[b]; Ex. G-2 ("LI") at 1[c], 9[b]; Ex. G-3 ("Marinier") at 1[c], 9[b]; Ex. G-4 ("Nayeb Nazar") at 1[c], [9[b]; Ex. G-5 ("Shaheen") at 1[c], 9[b]; Ex. G-6 ("Takeda I") at 1[c], 9[b]; Ex. G-7 ("Takeda II") at 1[c], 9[b]; Ex. G-8 ("Takeda III") at 1[c], 9[b]; Ex. G-9 ("Yan") at 1[c], 9[b]; Ex. G-10 ("Yang") at 1[c], 9[b]; Ex. G-11 ("Zhang") at 1[c], 9[b]; Ex. G-12 ("R1-1709802") at 1[c], 9[b]; Ex. G-13 ("R1-1713181") at 1[c], 9[b]; Ex. G-14 ("R1-1714079") at 1[c], 9[b]; G-16 ("Oh") at 1[c], 9[b]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data on a particular uplink or downlink resource ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These

combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "transmitting UL control information through the determined UL control channel resource," "receiving the UL control information through one of UL control channel resources in one of UL control channel resource sets contained in the transmitted UL control channel resource set configuration information," or "a transmitter configured to transmit the UL control information through the determined UL control channel resource," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 1[d], 5[b], 9[c]; Ex. G-2 ("LI") at 1[d], 5[b], 9[c]; Ex. G-3 ("Marinier") at 1[d], 5[b], 9[c]; Ex. G-4 ("Nayeb Nazar") at 1[d], 5[b], 9[c]; Ex. G-5 ("Shaheen") at 1[d], 5[b], 9[c]; Ex. G-6 ("Takeda I") at 1[d], 5[b], 9[c]; Ex. G-7 ("Takeda II") at 1[d], 5[b], 9[c]; Ex. G-8 ("Takeda III") at 1[d], 5[b], 9[c]; Ex. G-9 ("Yan") at 1[d], 5[b], 9[c]; Ex. G-10 ("Yang") at 1[d], 5[b], 9[c]; Ex. G-11 ("Zhang") at 1[d], 5[b], 9[c]; Ex. G-12 ("R1-1709802") at 1[d], 5[b], 9[c]; Ex. G-13 ("R1-1713181") at 1[d], 5[b], 9[c]; Ex. G-14 ("R1-1714079") at 1[d], 5[b], 9[c]; G-16 ("Oh") at 1[d], 5[b], 9[c]. The '000 patent further admits that

various methods were known in the art for transmitting and/or receiving uplink and downlink data on a particular uplink or downlink resource ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information" or "wherein the one of the UL control channel resource sets for the UL control information transmission is determined based on a size of the UL control information," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities. *See, e.g.*, Ex. G-1 ("Ahn") at 1[e], 5[c], 9[d]; Ex. G-2 ("LI") at 1[e], 5[c], 9[d]; Ex. G-3 ("Marinier") at 1[e], 5[c], 9[d]; Ex. G-4 ("Nayeb Nazar") at 1[e], 5[c], 9[d]; Ex. G-5 ("Shaheen") at 1[e], 5[c], 9[d]; Ex. G-6 ("Takeda I") at 1[e], 5[c], 9[d]; Ex. G-7 ("Takeda II") at 1[e], 5[c], 9[d];

Ex. G-8 ("Takeda III") at 1[e], 5[c], 9[d]; Ex. G-9 ("Yan") at 1[e], 5[c], 9[d]; Ex. G-10 ("Yang") at 1[e], 5[c], 9[d]; Ex. G-11 ("Zhang") at 1[e], 5[c], 9[d]; Ex. G-12 ("R1-1709802") at 1[e], 5[c], 9[d]; Ex. G-13 ("R1-1713181") at 1[e], 5[c], 9[d]; Ex. G-14 ("R1-1714079") at 1[e], 5[c], 9[d]; G-16 ("Oh") at 1[e], 5[c], 9[d]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities, including that "typical LTE . . . defines different PUCCH formats according to payload sizes of uplink control information." ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "wherein the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment

(user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 1[f], 5[d], 9[e]; Ex. G-2 ("LI") at 1[f], 5[d], 9[e]; Ex. G-3 ("Marinier") at 1[f], 5[d], 9[e]; Ex. G-4 ("Nayeb Nazar") at 1[f], 5[d], 9[e]; Ex. G-5 ("Shaheen") at 1[f], 5[d], 9[e]; Ex. G-6 ("Takeda I") at 1[f], 5[d], 9[e]; Ex. G-7 ("Takeda II") at 1[f], 5[d], 9[e]; Ex. G-8 ("Takeda III") at 1[f], 5[d], 9[e]; Ex. G-9 ("Yan") at 1[f], 5[d], 9[e]; Ex. G-10 ("Yang") at 1[f], 5[d], 9[e]; Ex. G-11 ("Zhang") at 1[f], 5[d], 9[e]; Ex. G-12 ("R1-1709802") at 1[f], 5[d], 9[e]; Ex. G-13 ("R1-1713181") at 1[f], 5[d], 9[e]; Ex. G-14 ("R1-1714079") at 1[f], 5[d], 9[e]; G-16 ("Oh") at 1[f], 5[d], 9[e]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the UE," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this

limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities. *See, e.g.*, Ex. G-1 ("Ahn") at cl. 2, 6, 10; Ex. G-2 ("LI") at cl. 2, 6, 10; Ex. G-3 ("Marinier") at cl. 2, 6, 10; Ex. G-4 ("Nayeb Nazar") at cl. 2, 6, 10; Ex. G-5 ("Shaheen") at cl. 2, 6, 10; Ex. G-6 ("Takeda I") at cl. 2, 6, 10; Ex. G-7 ("Takeda II") at cl. 2, 6, 10; Ex. G-8 ("Takeda III") at cl. 2, 6, 10; Ex. G-9 ("Yan") at cl. 2, 6, 10; Ex. G-10 ("Yang") at cl. 2, 6, 10; Ex. G-11 ("Zhang") at cl. 2, 6, 10; Ex. G-12 ("R1-1709802") at cl. 2, 6, 10; Ex. G-13 ("R1-1713181") at cl. 2, 6, 10; Ex. G-14 ("R1-1714079") at cl. 2, 6, 10; G-16 ("Oh") at cl. 2, 6, 10. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "wherein the each UL BWP is activated through downlink (DL) control information," it would have been

obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities. *See, e.g.*, Ex. G-1 ("Ahn") at cl. 3, 7, 11; Ex. G-2 ("LI") at cl. 3, 7, 11; Ex. G-3 ("Marinier") at cl. 3, 7, 11; Ex. G-4 ("Nayeb Nazar") at cl. 3, 7, 11; Ex. G-5 ("Shaheen") at cl. 3, 7, 11; Ex. G-6 ("Takeda I") at cl. 3, 7, 11; Ex. G-7 ("Takeda II") at cl. 3, 7, 11; Ex. G-8 ("Takeda III") at cl. 3, 7, 11; Ex. G-9 ("Yan") at cl. 3, 7, 11; Ex. G-10 ("Yang") at cl. 3, 7, 11; Ex. G-11 ("Zhang") at cl. 3, 7, 11; Ex. G-12 ("R1-1709802") at cl. 3, 7, 11; Ex. G-13 ("R1-1713181") at cl. 3, 7, 11; Ex. G-14 ("R1-1714079") at cl. 3, 7, 11; G-15 ("R1-1711853") at cl. 3, 7, 11; G-16 ("Oh") at cl. 3, 7, 11. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "receiving, from the base station, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission," "transmitting, to the user equipment, downlink (DL) control information containing information that indicates the one of the UL control channel resources for the UL control information transmission," or "wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 4[a], 8[a], 12[a]; Ex. G-2 ("LI") at 4[a], 8[a], 12[a]; Ex. G-3 ("Marinier") at 4[a], 8[a], 12[a]; Ex. G-4 ("Nayeb Nazar") at 4[a], 8[a], 12[a]; Ex. G-5 ("Shaheen") at 4[a], 8[a], 12[a]; Ex. G-6 ("Takeda I") at 4[a], 8[a], 12[a]; Ex. G-7 ("Takeda II") at 4[a], 8[a], 12[a]; Ex. G-8 ("Takeda III") at 4[a], 8[a], 12[a]; Ex. G-9 ("Yan") at 4[a], 8[a], 12[a]; Ex. G-10 ("Yang") at 4[a], 8[a], 12[a]; Ex. G-11 ("Zhang") at 4[a], 8[a], 12[a]; Ex. G-12 ("R1-1709802") at 4[a], 8[a], 12[a]; Ex. G-13 ("R1-1713181") at 4[a], 8[a], 12[a]; Ex. G-14 ("R1-1714079") at 4[a], 8[a], 12[a]; G-15 ("R1-1711853") at 4[a], 8[a], 12[a]; G-16 ("Oh") at 4[a], 8[a], 12[a]. The '000 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and

variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits G-1–G-16 do not disclose "wherein the one of the UL control channel resources is indicated from the base station through the DL control information" or "wherein the one of the UL control channel resources is indicated to the UE through the DL control information," it would have been obvious to combine any of the references charted in Exhibits G-1–G-16 with any of the other references charted in Exhibits G-1–G-16, each of which discloses this limitation as shown in G-1–G-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. G-1 ("Ahn") at 4[b], 8[b], 12[b]; Ex. G-2 ("LI") at 4[b], 8[b], 12[b]; Ex. G-3 ("Marinier") at 4[b], 8[b], 12[b]; Ex. G-4 ("Nayeb Nazar") at 4[b], 8[b], 12[b]; Ex. G-5 ("Shaheen") at 4[b], 8[b], 12[b]; Ex. G-6 ("Takeda I") at 4[b], 8[b], 12[b]; Ex. G-7 ("Takeda II") at 4[b], 8[b], 12[b]; Ex. G-8 ("Takeda III") at 4[b], 8[b], 12[b]; Ex. G-9 ("Yan") at 4[b], 8[b], 12[b]; Ex. G-10 ("Yang") at 4[b], 8[b], 12[b]; Ex. G-11 ("Zhang") at 4[b], 8[b], 12[b]; Ex. G-12 ("R1-1709802") at 4[b], 8[b], 12[b]; Ex. G-13 ("R1-1713181") at 4[b], 8[b], 12[b]; Ex. G-14 ("R1-1714079") at 4[b], 8[b], 12[b]; G-15 ("R1-1711853") at 4[b], 8[b], 12[b]; G-16 ("Oh") at 4[b], 8[b], 12[b]. The '000 patent further admits that various methods were known in the art for

transmitting and/or receiving uplink and downlink data on a particular uplink or downlink resource (’000 patent at 7:41-59, 8:8-20). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

h) Exemplary Motivation to Combine for the ’463 Patent

(1) Takeda III in view of Yan

To the extent the references charted in Exhibits H-1–H-16 do not disclose every limitation of the ’463 patent, it would have been obvious to combine Takeda III, charted in Exhibit H-8, with Yan, charted in Exhibit H-9, each of which discloses every claim of the ’463 patent as shown in H-8 and H-9. Both Yan and Takeda III are in the same technical field related to the efficient transmission of UCI. More particularly, Yan is directed towards allocating resources for the transmission of UCI in a manner that reduces overall resource consumption. Similarly, Takeda III is directed towards activating/deactivating UL BWPs for transmitting UCI in a manner that reduces a processing load at a user terminal. Moreover, Yan and Takeda III disclose similar methods for transmitting UCI. For example, both Yan and Takeda III disclose receiving resource set configuration information, determining a resource set from the configuration information, determining a resource within the resource set based on DCI, and transmitting UCI in the

determined resource. As both Yan and Takeda III relate to similar fields and describe similar functionality, a person having ordinary skill in the art would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Yan related to resource allocation for UCI transmission with the BWP-specific teachings of Takeda III. Further, a person having ordinary skill in the art would have been motivated to modify Takeda III with the teachings of Yan to provide Takeda III with backwards network compatibility and to incorporate Yan's methods for conserving UE power by strategically allocating UL channel resources into Takeda III's methods for transmitting UL signals within BWPs.

(2) Marinier in view of Yan and R1-1711853

To the extent the references charted in Exhibits H-1–H-16 do not disclose every limitation of the '000 patent, it would have been obvious to combine Mariner, charted in Exhibit H-3, with Yan, charted in Exhibit H-9, and R1-1711853, charted in Exhibit H-15, each of which discloses every claim of the '000 patent as shown in H-3, H-9, and H-15. A person having ordinary skill in the art would have been motivated to modify Marinier's methods for transmitting UL signals to incorporate Yan's methods for allocating UL channel resources to determine the most efficient UL channel resource based on a size of the UCI. Yan explains that the capacity of UL channel resources specified by a BS may be underutilized, or UCI bits may be discarded if the size of the UL channel does not meet the size of UCI. This mismatch of UL channel resource size and UCI size is applicable for Marinier's BWP-based UL signaling configuration. Therefore, a person having ordinary skill in the art would have incorporated Yan's resource allocation methodology of determining an UL channel resource set based on UCI size to efficiently utilize Marinier's UL channel resources and to conserve UE power during UL signaling. Using Yan's resource allocation methodology within UL BWPs of Marinier would ensure that UCI bits are not discarded and

minimizes UL resource consumption by UEs during UL transmission. Further, Marinier and Yan both discuss UCI transmission and resource allocation for transmitting UCI. Moreover, Marinier discusses that PUCCH parameters usable in specific BWPs are received from the BS, including "preconfigured set[s] of parameters" that define dedicated PUCCH resources control UL transmissions. Yan discloses analogous features for determining a channel resource for UL signaling from resource sets included in configuration information from a BS. Therefore, a person having ordinary skill in the art would have recognized that Marinier's methods for selecting a "preconfigured set of parameters" for UL transmission would be adaptable to utilize Yan's configuration information received from the BS, for example so that the UE can determine an UL resource using the configuration information. Similarly, a person having ordinary skill in the art would have been motivated to modify the UL signaling method as taught by Marinier and Yan with the teachings of R1-1711853 to incorporate the BWP activation protocol proposed in R1-1711853 to achieve improved power efficiency when transmitting UL signals from a UE using 5G NR. Marinier explains that its resource allocation methods provide power efficiency by selecting optimal UL resources for UCI. Incorporating 5G NR's BWPs and methods of activating those BWPs would further Marinier's stated goal of conserving UE power because 5G NR BWPs allow UEs to transmit on a portion of the carrier frequency band, instead of the entire carrier frequency band.

(3) Takeda III in view of Ahn

To the extent the references charted in Exhibits H-1–H-16 do not disclose every limitation of the '463 patent, it would have been obvious to combine Takeda III, charted in Exhibit H-8, with Ahn, charted in Exhibit H-1, each of which discloses every claim of the '463 patent as shown in H-8 and H-1. Both Takeda III and Ahn are in the same technical field related to improved

communications in LTE-A and NR systems. Moreover, both Takeda III and Ahn describe the need for greater bandwidth flexibility in LTE-A and NR systems, such as through techniques including carrier aggregation and bandwidth parts (BWPs). More particularly, Takeda III is directed towards enabling activation/deactivation of one or more DL and/or UL BWPs for the reception of DCI and transmission of UCI based on the received DCI. Similarly, Ahn is directed towards a method for transmitting UCI through a PUCCH resource indicated or allocated by DCI. As both Takeda III and Ahn relate to similar functionality, a POSITA would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Ahn related to transmitting UCI on a resource allocated by DCI with the BWP-specific teachings of Takeda.

(4) Takeda III in view of Yang

To the extent the references charted in Exhibits H-1–H-16 do not disclose every limitation of the ’463 patent, it would have been obvious to combine Takeda III, charted in Exhibit H-8, with Yang, charted in Exhibit H-10, each of which discloses every claim of the ’463 patent as shown in H-8 and H-10. Both Takeda III and Yang are in the same technical field related to techniques for minimizing retransmission time and data delivery latency in NR systems. More particularly, Takeda III is directed towards efficient UCI transmission by selectively activating or deactivating one or more BWPs through which DCI is received and UCI is transmitted based on the received DCI. Similarly, Yang is directed towards configuring a plurality of transmission delays and a plurality of resources from which a transmission delay and resource are selected based on received DCI. Yang further discloses that the transmission delays and resources may be configured differently for each BWP, and the UE may dynamically switch BWPs according to transmission requirements. As both Takeda III and Yang relate to similar functionality, a POSITA would have

been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Yang related to dynamically configuring and selecting transmissions delays and/or resources with the BWP-specific teachings of Takeda III.

(5) Shaheen in view of R1-1709802 and R1-1714079

To the extent the references charted in Exhibits H-1–H-16 do not disclose every limitation of the '463 patent, it would have been obvious to combine Shaheen, charted in Exhibit H-5, with R1-1709802 and R1-1714079, charted in Exhibits H-12 and H-14, respectively, all of which discloses every claim of the '463 patent as shown in H-5, H-12, and H-14. Shaheen, R1-1709802, and R1-1714079 are in the same technical field related to configuring and allocating resources for efficient DL and UL transmissions in NR systems. More particularly, Shaheen is directed towards enhancements to the Scheduling Request (SR) feature in NR systems. Shaheen discloses that a gNodeB may configure one or more sets of PUCCH resources and/or corresponding BWPs for SR/UCI transmission, provide the configured resource sets and/or BWPs to the UE, and transmit SR/UCI on a PUCCH resource and configured BWP. Similarly, R1-1714079 is a 3GPP proposal directed towards PUCCH resource allocation for UCI transmission in NR, including proposals for configuring multiple PUCCH resource sets, selecting a resource set from the multiple PUCCH resource sets, and using DCI to select a resource from the selected resource set for UCI transmission. Similarly, R1-1709802 is a 3GPP proposal directed to using BWPs for efficient wideband operation in NR. R1-1709802 discloses that each BWP configurations include at least one control resource set (CORESET) and that an active DL/UL BWP may be indicated by DCI. As Shaheen, R1-1714079, and R1-1709802 each relate to configuring and allocating resources for efficient DL and UL transmissions in NR systems, a POSITA would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Shaheen and R1-1714079 related to configuring and allocating resources for UCI transmission

with the BWP-specific teachings of R1-1709802. Moreover, it would have been obvious to combine Shaheen and R1-1709802 because each relates to configuring resources/BWPs and selecting or indicating a resource/BWP for UCI transmission. Further still, it would have been obvious to combine R1-1714079 and R1-1709802 because both are 3GPP proposals that describe configuring PUCCH resources and BWPs for efficient operation in NR.

(6) Additional References

To the extent the references charted in Exhibits H-1–H-16 do not disclose "[a] method of transmitting uplink (UL) control information by a user equipment," "[a] method of receiving uplink (UL) control information by a base station," or "[a] user equipment for transmitting uplink (UL) control information," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. H-1 ("Ahn") at 1[pre], 4[pre], 7[pre]; Ex. H-2 ("LI") at 1[pre], 4[pre], 7[pre]; Ex. H-3 ("Marinier") at 1[pre], 4[pre], 7[pre]; Ex. H-4 ("Nayeb Nazar") at 1[pre], 4[pre], 7[pre]; Ex. H-5 ("Shaheen") at 1[pre], 4[pre], 7[pre]; Ex. H-6 ("Takeda I") at 1[pre], 4[pre], 7[pre]; Ex. H-7 ("Takeda II") at 1[pre], 4[pre], 7[pre]; Ex. H-8 ("Takeda III") at 1[pre], 4[pre], 7[pre]; Ex. H-9 ("Yan") at 1[pre], 4[pre], 7[pre]; Ex. H-10 ("Yang") at 1[pre], 4[pre], 7[pre]; Ex. H-11 ("Zhang") at 11[pre], 4[pre], 7[pre]; Ex. H-12 ("R1-1709802") at 1[pre], 4[pre], 7[pre]; Ex. H-13 ("R1-1713181") at 1[pre], 4[pre], 7[pre]; Ex. H-14 ("R1-1714079") at 1[pre], 4[pre], 7[pre]; H-16 ("Oh") at 1[pre], 4[pre], 7[pre]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('463 patent at 6:56-63, 7:29-

36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "receiving, from a base station, UL control channel resource set configuration information for UL control information transmission," "transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment," or "a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control information transmission," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. H-1 ("Ahn") at 1[a], 4[a], 7[a]; Ex. H-2 ("LI") at 1[a], 4[a], 7[a]; Ex. H-3 ("Marinier") at 1[a], 4[a], 7[a]; Ex. H-4 ("Nayeb Nazar") at 1[a], 4[a], 7[a]; Ex. H-5 ("Shaheen") at 1[a], 4[a], 7[a]; Ex. H-6 ("Takeda I") at 1[a], 4[a], 7[a]; Ex. H-7 ("Takeda II")

at 1[a], 4[a], 7[a]; Ex. H-8 ("Takeda III") at 1[a], 4[a], 7[a]; Ex. H-9 ("Yan") at 1[a], 4[a], 7[a]; Ex. H-10 ("Yang") at 1[a], 4[a], 7[a]; Ex. H-11 ("Zhang") at 1[a], 4[a], 7[a]; Ex. H-12 ("R1-1709802") at 1[a], 4[a], 7[a]; Ex. H-13 ("R1-1713181") at 1[a], 4[a], 7[a]; Ex. H-14 ("R1-1714079") at 1[a], 4[a], 7[a]; H-16 ("Oh") at 1[a], 4[a], 7[a]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "determining one of UL control channel resource sets contained in the UL control channel resource set configuration information" or "a controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set configuration information," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for

transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. H-1 ("Ahn") at 1[b], 7[b]; Ex. H-2 ("LI") at 1[b], 7[b]; Ex. H-3 ("Marinier") at 1[b], 7[b]; Ex. H-4 ("Nayeb Nazar") at 1[b], 7[b]; Ex. H-5 ("Shaheen") at 1[b], 7[b]; Ex. H-6 ("Takeda I") at 1[b], 7[b] Ex. H-7 ("Takeda II") at 1[b], 7[b]; Ex. H-8 ("Takeda III") at 1[b], 7[b]; Ex. H-9 ("Yan") at 1[b], 7[b]; Ex. H-10 ("Yang") at 1[b], 7[b]; Ex. H-11 ("Zhang") at 1[b], 7[b]; Ex. H-12 ("R1-1709802") at 1[b], 7[b]; Ex. H-13 ("R1-1713181") at 1[b], 7[b]; Ex. H-14 ("R1-1714079") at 1[b], 7[b]; H-16 ("Oh") at 1[b], 7[b]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "determining one of UL control channel resources contained in the determined UL control channel resource set" or "a controller configured to determine . . . one of UL control channel resources configuring the determined one UL control channel resource set," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-

1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data using an uplink or downlink resource. *See, e.g.*, Ex. H-1 ("Ahn") at 1[c], 7[b]; Ex. H-2 ("LI") at 1[c], 7[b]; Ex. H-3 ("Marinier") at 1[c], 7[b]; Ex. H-4 ("Nayeb Nazar") at 1[c], [7[b]; Ex. H-5 ("Shaheen") at 1[c], 7[b]; Ex. H-6 ("Takeda I") at 1[c], 7[b]; Ex. H-7 ("Takeda II") at 1[c], 7[b]; Ex. H-8 ("Takeda III") at 1[c], 7[b]; Ex. H-9 ("Yan") at 1[c], 7[b]; Ex. H-10 ("Yang") at 1[c], 7[b]; Ex. H-11 ("Zhang") at 1[c], 7[b]; Ex. H-12 ("R1-1709802") at 1[c], 7[b]; Ex. H-13 ("R1-1713181") at 1[c], 7[b]; Ex. H-14 ("R1-1714079") at 1[c], 7[b]; H-16 ("Oh") at 1[c], 7[b]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data on a particular uplink or downlink resource ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "transmitting UL control information through the determined UL control channel resource," "receiving the UL

control information through one of UL control channel resources configuring one of UL control channel resource sets contained in UL control channel resource set configuration information," or "a transmitter configured to transmit the UL control information through the determined UL control channel resource," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. H-1 ("Ahn") at 1[d], 4[b], 7[c]; Ex. H-2 ("LI") at 1[d], 4[b], 7[c]; Ex. H-3 ("Marinier") at 1[d], 4[b], 7[c]; Ex. H-4 ("Nayeb Nazar") at 1[d], 4[b], 7[c]; Ex. H-5 ("Shaheen") at 1[d], 4[b], 7[c]; Ex. H-6 ("Takeda I") at 1[d], 4[b], 7[c]; Ex. H-7 ("Takeda II") at 1[d], 4[b], 7[c]; Ex. H-8 ("Takeda III") at 1[d], 4[b], 7[c]; Ex. H-9 ("Yan") at 1[d], 4[b], 7[c]; Ex. H-10 ("Yang") at 1[d], 4[b], 7[c]; Ex. H-11 ("Zhang") at 1[d], 4[b], 7[c]; Ex. H-12 ("R1-1709802") at 1[d], 4[b], 7[c]; Ex. H-13 ("R1-1713181") at 1[d], 4[b], 7[c]; Ex. H-14 ("R1-1714079") at 1[d], 4[b], 7[c]; H-16 ("Oh") at 1[d], 4[b], 7[c]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data on a particular uplink or downlink resource ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success

to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities. *See, e.g.*, Ex. H-1 ("Ahn") at 1[e], 4[c], 7[d]; Ex. H-2 ("LI") at 1[e], 4[c], 7[d]; Ex. H-3 ("Marinier") at 1[e], 4[c], 7[d]; Ex. H-4 ("Nayeb Nazar") at 1[e], 4[c], 7[d]; Ex. H-5 ("Shaheen") at 1[e], 4[c], 7[d]; Ex. H-6 ("Takeda I") at 1[e], 4[c], 7[d]; Ex. H-7 ("Takeda II") at 1[e], 4[c], 7[d]; Ex. H-8 ("Takeda III") at 1[e], 4[c], 7[d]; Ex. H-9 ("Yan") at 1[e], 4[c], 7[d]; Ex. H-10 ("Yang") at 1[e], 4[c], 7[d]; Ex. H-11 ("Zhang") at 1[e], 4[c], 7[d]; Ex. H-12 ("R1-1709802") at 1[e], 4[c], 7[d]; Ex. H-13 ("R1-1713181") at 1[e], 4[c], 7[d]; Ex. H-14 ("R1-1714079") at 1[e], 4[c], 7[d]; H-16 ("Oh") at 1[e], 4[c], 7[d]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a

combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "wherein the each UL BWP is activated through downlink (DL) control information," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities. *See, e.g.*, Ex. H-1 ("Ahn") at 1[f], 4[d], 7[e]; Ex. H-2 ("LI") at 1[f], 4[d], 7[e]; Ex. H-3 ("Marinier") at 1[f], 4[d], 7[e]; Ex. H-4 ("Nayeb Nazar") at 1[f], 4[d], 7[e]; Ex. H-5 ("Shaheen") at 1[f], 4[d], 7[e]; Ex. H-6 ("Takeda I") at 1[f], 4[d], 7[e]; Ex. H-7 ("Takeda II") at 1[f], 4[d], 7[e]; Ex. H-8 ("Takeda III") at 1[f], 4[d], 7[e]; Ex. H-9 ("Yan") at 1[f], 4[d], 7[e]; Ex. H-10 ("Yang") at 1[f], 4[d], 7[e]; Ex. H-11 ("Zhang") at 1[f], 4[d], 7[e]; Ex. H-12 ("R1-1709802") at 1[f], 4[d], 7[e]; Ex. H-13 ("R1-1713181") at 1[f], 4[d], 7[e]; Ex. H-14 ("R1-1714079") at 1[f], 4[d], 7[e]; H-15 ("R1-1711853") at 1[f], 4[d], 7[e]; H-16 ("Oh") at 1[f], 4[d], 7[e]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references

to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information" or "wherein the one of the UL control channel resource sets for the UL control information transmission is determined based on a size of the UL control information," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities. *See, e.g.*, Ex. H-1 ("Ahn") at cl. 2, 5, 8; Ex. H-2 ("LI") at cl. 2, 5, 8; Ex. H-3 ("Marinier") at cl. 2, 5, 8; Ex. H-4 ("Nayeb Nazar") at cl. 2, 5, 8; Ex. H-5 ("Shaheen") at cl. 2, 5, 8; Ex. H-6 ("Takeda I") at cl. 2, 5, 8; Ex. H-7 ("Takeda II") at cl. 2, 5, 8; Ex. H-8 ("Takeda III") at cl. 2, 5, 8; Ex. H-9 ("Yan") at cl. 2, 5, 8; Ex. H-10 ("Yang") at cl. 2, 5, 8; Ex. H-11 ("Zhang") at cl. 2, 5, 8; Ex. H-12 ("R1-1709802") at cl. 2, 5, 8; Ex. H-13 ("R1-1713181") at cl. 2, 5, 8; Ex. H-

14 ("R1-1714079") at cl. 2, 5, 8; Ex. H-16 ("Oh") at cl. 2, 5, 8. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data according to transmission/reception capabilities, including that "typical LTE . . . defines different PUCCH formats according to payload sizes of uplink control information." ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "receiving, from the base station, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission," "transmitting, to the user equipment, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission," or "wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation

as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. H-1 ("Ahn") at 3[a], 6[a], 9[a]; Ex. H-2 ("LI") at 3[a], 6[a], 9[a]; Ex. H-3 ("Marinier") at 3[a], 6[a], 9[a]; Ex. H-4 ("Nayeb Nazar") at 3[a], 6[a], 9[a]; Ex. H-5 ("Shaheen") at 3[a], 6[a], 9[a]; Ex. H-6 ("Takeda I") at 3[a], 6[a], 9[a]; Ex. H-7 ("Takeda II") at 3[a], 6[a], 9[a]; Ex. H-8 ("Takeda III") at 3[a], 6[a], 9[a]; Ex. H-9 ("Yan") at 3[a], 6[a], 9[a]; Ex. H-10 ("Yang") at 3[a], 6[a], 9[a]; Ex. H-11 ("Zhang") at 3[a], 6[a], 9[a]; Ex. H-12 ("R1-1709802") at 3[a], 6[a], 9[a]; Ex. H-13 ("R1-1713181") at 3[a], 6[a], 9[a]; Ex. H-14 ("R1-1714079") at 3[a], 6[a], 9[a]; H-15 ("R1-1711853") at 3[a], 6[a], 9[a]; H-16 ("Oh") at 3[a], 6[a], 9[a]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits H-1–H-16 do not disclose "wherein the one of the UL control channel resources is indicated from the base station through the DL control

information" or "wherein the one of the UL control channel resources is indicated to the user equipment through the DL control information," it would have been obvious to combine any of the references charted in Exhibits H-1–H-16 with any of the other references charted in Exhibits H-1–H-16, each of which discloses this limitation as shown in H-1–H-16. A person of skill in the art would be motivated to combine these references because the references all disclose methods and equipment (user equipment and base stations) for transmitting and/or receiving uplink and downlink data. *See, e.g.*, Ex. H-1 ("Ahn") at 3[b], 6[b], 9[b]; Ex. H-2 ("LI") at 3[b], 6[b], 9[b]; Ex. H-3 ("Marinier") at 3[b], 6[b], 9[b]; Ex. H-4 ("Nayeb Nazar") at 3[b], 6[b], 9[b]; Ex. H-5 ("Shaheen") at 3[b], 6[b], 9[b]; Ex. H-6 ("Takeda I") at 3[b], 6[b], 9[b]; Ex. H-7 ("Takeda II") at 3[b], 6[b], 9[b]; Ex. H-8 ("Takeda III") at 3[b], 6[b], 9[b]; Ex. H-9 ("Yan") at 3[b], 6[b], 9[b]; Ex. H-10 ("Yang") at 3[b], 6[b], 9[b]; Ex. H-11 ("Zhang") at 3[b], 6[b], 9[b]; Ex. H-12 ("R1-1709802") at 3[b], 6[b], 9[b]; Ex. H-13 ("R1-1713181") at 3[b], 6[b], 9[b]; Ex. H-14 ("R1-1714079") at 3[b], 6[b], 9[b]; H-15 ("R1-1711853") at 3[b], 6[b], 9[b]; H-16 ("Oh") at 3[b], 6[b], 9[b]. The '463 patent further admits that various methods were known in the art for transmitting and/or receiving uplink and downlink data on a particular uplink or downlink resource ('463 patent at 6:56-63, 7:29-36, 7:63-8:8). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations

would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

i) Exemplary Motivation to Combine for the '272 Patent

(1) Lee '434 in view of You

To the extent that the references charted in Exhibits I-1–I-7 do not disclose every limitation of the '272 Patent, it would have been obvious to combine Lee '434, charted in Exhibit I-1 with You, charted in Exhibit I-2, each of which discloses every claim of the '272 Patent as shown in Exhibits I-1 and I-2. To solve the technical problem of allocating a time-domain resources for downlink data channel (PDSCH) or uplink data channel (PUSCH) transmission/reception, a person of ordinary skill in the art would be motivated to combine these references for several reasons. Both references disclose methods related to allocating resources on PUSCH: Lee '434 discloses the need to identify an urgent PUSCH resource location, while You discloses new methods in which the BS efficiently receives/transmits uplink/downlink data and/or uplink/downlink control information using the limited radio resources is needed. Additionally, both references are directed to improving communication in low latency situations and reducing delay. Finally, a POSITA would be motivated to combine references directed to the same field that are assigned to the same owner, in this case LG Electronics Inc. Thus, a POSITA would be motivated to combine Lee '434 and You, and it would have been obvious to do so.

(2) Lee '325 in view of Lee '434

To the extent that the references charted in Exhibits I-1–I-7 do not disclose every limitation of the '272 Patent, it would have been obvious to combine Lee '325, charted in Exhibit I-1 with Lee '434, charted in Exhibit I-3, each of which discloses every claim of the '272 Patent as shown in Exhibits I-1 and I-3. To solve the technical problem of allocating a time-domain resources for downlink data channel (PDSCH) or uplink data channel (PUSCH) transmission/reception, a person

of ordinary skill in the art would be motivated to combine these references for several reasons. The references come from the same group of inventors, and both references disclose methods related to allocating resources on PUSCH. Additionally, both references are directed to improving communication in low latency situations and reducing delay. Finally, a POSITA would be motivated to combine references directed to the same field that are assigned to the same owner, in this case LG Electronics Inc. Thus, a POSITA would be motivated to combine Lee '325 and Lee '434, and it would have been obvious to do so.

(3) Lee '325 in view of Park

To the extent that the references charted in Exhibits I-1–I-7 do not disclose every limitation of the '272 Patent, it would have been obvious to combine Lee '325, charted in Exhibit I-1 with Park, charted in Exhibit I-6, each of which discloses every claim of the '272 Patent as shown in Exhibits I-1 and I-6. To solve the technical problem of allocating a time-domain resources for downlink data channel (PDSCH) or uplink data channel (PUSCH) transmission/reception, a person of ordinary skill in the art would be motivated to combine these references for several reasons. Both references are directed toward improving efficiency in low latency conditions in wireless communications, and both specifically disclose scheduling channel resources using downlink control information (DCI). Furthermore, the technical problem posed in Lee '325 is the need to improve transmission in low-latency communication. Park presents a possible solution by using fewer OFDM symbols on the PDSCH and/or PUSCH, thereby improving communication efficiency. Finally, a POSITA would be motivated to combine references directed to the same field that are assigned to the same owner, in this case LG Electronics Inc. Thus, a POSITA would be motivated to combine Lee '325 and Park, and it would have been obvious to do so.

(4) Gao in view of You

To the extent that the references charted in Exhibits I-1–I-7 do not disclose every limitation of the ’272 Patent, it would have been obvious to combine You, charted in Exhibit I-2 with Gao, charted in Exhibit I-7, each of which discloses every claim of the ’272 Patent as shown in Exhibits I-1 and I-7. The technology and teachings of Gao and You heavily overlap, as both references teach the same basic concept of a BS allocating resources for wireless transmissions to/from a UE on a PDSCH (from BS to UE) and PUSCH (from UE to BS). Both references teach communicating the allocations in various format to the UE. Both references teach using resource “patterns” to communicate the specific OFDM symbols in the resource allocations through “regions” of allocated symbols. Thus, a POSITA would be motivated to combine You and Gao, and it would have been obvious to do so.

(5) Additional References

To the extent the references charted in Exhibits I-1–I-7 do not disclose “a base station, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations,” or “a wireless device, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations” or “an operation method of a wireless device,” it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose “a base station, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations,” or “a wireless device, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations” or “an

operation method of a wireless device." *See, e.g.*, Exhibits I-1–I-7 at 1[pre], 8[pre-c], and 15[pre]. The '272 patent further admits that various methods were known in the art for "a base station, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations," or "a wireless device, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations" or "an operation method of a wireless device." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "a base station, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations," or "a wireless device, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations" or "an operation method of a wireless device," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "a base station,

comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations," or "a wireless device, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations" or "an operation method of a wireless device." *See, e.g.*, Appendix I at 1[pre], 8[pre-c], and 15[pre]. The '272 patent further admits that various methods were known in the art for "a base station, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations," or "a wireless device, comprising: a transceiver; a receiver; and a controller which controls the transceiver and receiver thereby performing operations" or "an operation method of a wireless device." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "transmitting, to a wireless device, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," or "receiving, from a base station, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of

the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "transmitting, to a wireless device, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," or "receiving, from a base station, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource." *See, e.g.*, Exhibits I-1–I-7 at 1[a], 8[d], and 15[a]. The '272 patent further admits that various methods were known in the art for "transmitting, to a wireless device, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," or "receiving, from a base station, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "transmitting, to a wireless device, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," or "receiving, from a base station, a radio resource control

(RRC) signal including information on one or more allocations of a time-domain resource," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "transmitting, to a wireless device, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," or "receiving, from a base station, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource." *See, e.g.*, Appendix I at 1[a], 8[d], and 15[a]. The '272 patent further admits that various methods were known in the art for "transmitting, to a wireless device, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource," or "receiving, from a base station, a radio resource control (RRC) signal including information on one or more allocations of a time-domain resource." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the time-domain resource includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the time-domain resource includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols." See, e.g., Exhibits I-1–I-7 at 1[a], 8[e], and 15[b]. The '272 patent further admits that various methods were known in the art for "wherein the time-domain resource includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the time-domain resource includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols," it would have been obvious to combine any of the references charted in

Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the time-domain resource includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols." See, e.g., Appendix I at 1[a], 8[e], and 15[b]. The '272 patent further admits that various methods were known in the art for "wherein the time-domain resource includes at least one or more orthogonal frequency-division multiplexing (OFDM) symbols." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein, based on the information, a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein, based on the information, a number of OFDM symbols are determined for a

physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)." See, e.g., Exhibits I-1–I-7 at 1[b], 8[f], and 15[c]. The '272 patent further admits that various methods were known in the art for "wherein, based on the information, a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein, based on the information, a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein, based on the information, a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)." See, e.g., Appendix I at 1[b], 8[f], and 15[c]. The '272 patent further admits that various methods were

known in the art for "wherein, based on the information, a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the determined number of OFDM symbols is smaller than or equal to a number of OFDM symbols included in a slot," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the determined number of OFDM symbols is smaller than or equal to a number of OFDM symbols included in a slot." See, e.g., Exhibits I-1–I-7 at 1[c], 8[g], and 15[d]. The '272 patent further admits that various methods were known in the art for "wherein the determined number of OFDM symbols is smaller than or equal to a number of OFDM symbols included in a slot." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to

achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

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of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "transmitting, to the wireless device, downlink control information (DCI), including a field including a bit string" or "receiving, from the base station, downlink control information (DCI), including a field including a bit string," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "transmitting, to the wireless device, downlink control information (DCI), including a field including a bit string" or "receiving, from the base station, downlink control information (DCI), including a field including a bit string." See, e.g., Exhibits I-1–I-7 at 1[d], 8[i], and 15[e]. The '272 patent further admits that various methods were known in the art for "transmitting, to the wireless device, downlink control information (DCI), including a field including a bit string" or "receiving, from the base station, downlink control information (DCI), including a field including a bit string." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there

were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "transmitting, to the wireless device, downlink control information (DCI), including a field including a bit string" or "receiving, from the base station, downlink control information (DCI), including a field including a bit string," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "transmitting, to the wireless device, downlink control information (DCI), including a field including a bit string" or "receiving, from the base station, downlink control information (DCI), including a field including a bit string." See, e.g., Appendix I at 1[d], 8[i], and 15[e]. The '272 patent further admits that various methods were known in the art for "transmitting, to the wireless device, downlink control information (DCI), including a field including a bit string" or "receiving, from the base station, downlink control information (DCI), including a field including a bit string." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there

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To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the bit string in the field relates to a row index of an allocation table," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the bit string in the field relates to a row index of an allocation table." See, e.g., Exhibits I-1–I-7 at 1[e], 8[j], and 15[f]. The '272 patent further admits that various methods were known in the art for "wherein the bit string in the field relates to a row index of an allocation table." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the bit string in the field relates to a row index of an allocation table," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the bit string in the field relates to a row index of an allocation table." See, e.g., Appendix I at 1[e], 8[j], and 15[f]. The '272 patent further admits that various methods were known in the art for "wherein the bit string in the field relates to a row index of an allocation table." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in

Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot." See, e.g., Exhibits I-1–I-7 at 1[f], 8[k], and 15[g]. The '272 patent further admits that various methods were known in the art for "wherein the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references

because the references all disclose "wherein the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot." See, e.g., Appendix I at 1[f], 8[k], and 15[g]. The '272 patent further admits that various methods were known in the art for "wherein the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the bit string is 3 bits in length," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the bit string is 3 bits in length." See, e.g., Exhibits I-1–I-7 at 2[a], 9[a], and 16[a]. The '272 patent further admits that various methods were known in the art for "wherein the bit string is 3 bits in length" ('272 patent

at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

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would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the DCI further includes information on one or more allocations of a frequency-domain resource," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the DCI further includes information on one or more allocations of a frequency-domain resource." See, e.g., Exhibits I-1–I-7 at 3[a], 10[a], and 17[a]. The '272 patent further admits that various methods were known in the art for "wherein the DCI further includes information on one or more allocations of a frequency-domain resource." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

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To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the base station supports a new radio access technology (NR)" or "wherein the wireless device supports a new radio access technology (NR)," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which

discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the base station supports a new radio access technology (NR)" or "wherein the wireless device supports a new radio access technology (NR)." See, e.g., Exhibits I-1–I-7 at 4[a], 11[a], and 18[a]. The '272 patent further admits that various methods were known in the art for "wherein the base station supports a new radio access technology (NR)" or "wherein the wireless device supports a new radio access technology (NR)." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the base station supports a new radio access technology (NR)" or "wherein the wireless device supports a new radio access technology (NR)," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the base station supports a new radio access technology (NR)" or "wherein the wireless device supports a new

radio access technology (NR).” See, e.g., Appendix I at 4[a], 11[a], and 18[a]. The ’272 patent further admits that various methods were known in the art for “wherein the base station supports a new radio access technology (NR)” or “wherein the wireless device supports a new radio access technology (NR).” (’272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose “wherein the base station supports different numerologies which are defined by a subcarrier spacing (SCS),” or “wherein the wireless device supports different numerologies which are defined by a subcarrier spacing (SCS),” it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose “wherein the base station supports different numerologies which are defined by a subcarrier spacing (SCS),” or “wherein the wireless device supports different numerologies which are defined by a subcarrier spacing (SCS).” See, e.g., Exhibits I-1–I-7 at 5[a], 12[a], and 19[a]. The ’272 patent further admits that various methods were

known in the art for "wherein the base station supports different numerologies which are defined by a subcarrier spacing (SCS)," or "wherein the wireless device supports different numerologies which are defined by a subcarrier spacing (SCS)." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the base station supports different numerologies which are defined by a subcarrier spacing (SCS)," or "wherein the wireless device supports different numerologies which are defined by a subcarrier spacing (SCS)," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the base station supports different numerologies which are defined by a subcarrier spacing (SCS)," or "wherein the wireless device supports different numerologies which are defined by a subcarrier spacing (SCS)." See, e.g., Appendix I at 5[a], 12[a], and 19[a]. The '272 patent further admits that various methods were known in the art for "wherein the base station supports different numerologies which are defined

by a subcarrier spacing (SCS)," or "wherein the wireless device supports different numerologies which are defined by a subcarrier spacing (SCS)." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the operations further include: transmitting, to the wireless device, downlink data via the PDSCH; and receiving, from the wireless device, uplink data via the PUSCH" or "wherein the operations further include: receiving, from the base station, downlink data via the PDSCH; and transmitting, to the base station, uplink data via the PUSCH," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the operations further include: transmitting, to the wireless device, downlink data via the PDSCH; and receiving, from the wireless device, uplink data via the PUSCH" or "wherein the operations further include: receiving, from the base station, downlink data via the PDSCH; and transmitting, to the base station, uplink data via the PUSCH." See, e.g., Exhibits I-1–I-7 at 6[a], 13[a], and 20[a]. The

'272 patent further admits that various methods were known in the art for "wherein the operations further include: transmitting, to the wireless device, downlink data via the PDSCH; and receiving, from the wireless device, uplink data via the PUSCH" or "wherein the operations further include: receiving, from the base station, downlink data via the PDSCH; and transmitting, to the base station, uplink data via the PUSCH." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the operations further include: transmitting, to the wireless device, downlink data via the PDSCH; and receiving, from the wireless device, uplink data via the PUSCH" or "wherein the operations further include: receiving, from the base station, downlink data via the PDSCH; and transmitting, to the base station, uplink data via the PUSCH," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the operations further include: transmitting, to the wireless device, downlink data via the PDSCH; and

receiving, from the wireless device, uplink data via the PUSCH" or "wherein the operations further include: receiving, from the base station, downlink data via the PDSCH; and transmitting, to the base station, uplink data via the PUSCH." See, e.g., Appendix I at 6[a], 13[a], and 20[a]. The '272 patent further admits that various methods were known in the art for "wherein the operations further include: transmitting, to the wireless device, downlink data via the PDSCH; and receiving, from the wireless device, uplink data via the PUSCH" or "wherein the operations further include: receiving, from the base station, downlink data via the PDSCH; and transmitting, to the base station, uplink data via the PUSCH." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the number of the OFDM symbols is a maximum of 14," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the other references in Exhibits I-1–I-7, each of which discloses this limitation as shown in Exhibits I-1–I-7. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the number of the OFDM symbols is a maximum of 14." See, e.g., Exhibits I-1–I-7

at 7[a] and 14[a]. The '272 patent further admits that various methods were known in the art for "wherein the number of the OFDM symbols is a maximum of 14." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits I-1–I-7 do not disclose "wherein the number of the OFDM symbols is a maximum of 14," it would have been obvious to combine any of the references charted in Exhibits I-1–I-7 with any of the references charted in Appendix I, each of which discloses this limitation as shown in Appendix I. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose "wherein the number of the OFDM symbols is a maximum of 14." See, e.g., Appendix I at 7[a] and 14[a]. The '272 patent further admits that various methods were known in the art for "wherein the number of the OFDM symbols is a maximum of 14." ('272 patent at 6:26-8:21). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into

account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

j) Exemplary Motivation to Combine for the '644 Patent

(1) Zhuang in view of Yang-084

To the extent the references charted in Exhibits J-1–J-8 do not disclose every limitation of the '644 patent, it would have been obvious to combine Zhaung, charted in Exhibit J-1, with Yang-084, charted in Exhibit J-2, each of which discloses and/or renders obvious every claim of the '644 patent, as shown in Exhibits J-1 and J-2. A person of ordinary skill would have been motivated to combine Zhuang and Yang-084 because they are both in the same field of telecommunications. Specifically, they relate to a method for transmitting and receiving downlink control information. Zhuang at 1:4-6 ("This disclosure relates generally to wireless communications and, more particularly, to determine the starting subframe of data channel reception or transmission."); Yang-084 at [0001] ("The present invention relates to a wireless communication system. More particularly, the present invention relates to a method and apparatus for transmitting/receiving a downlink signal and a method and apparatus for transmitting/receiving

an uplink signal."). Both references also teach about machine-to-machine (M2M) communication. Zhuang at 1:8-23; Yang at [0002].

A person of ordinary skill would have been motivated to combine Zhuang and Yang-084 because they have similar goals relating to enhancing coverage for MTC devices. Zhuang teaches, "3rd generation partnership project (3GPP) RAN1 working group have studied for coverage improvement and cost reduction for these MTC devices in coverage hole scenario. Some potential solutions have been identified such as repetition of the physical channels to improve the coverage." Zhuang at 1:14-17. Yang-084 teaches, "With appearance and spread of machine-to-machine (M2M) communication and a variety of devices such as smartphones and tablet PCs and technology demanding a large amount of data transmission . . . a new method for efficiently transmitting/receiving an uplink/downlink signal using the finite radio resources is needed." Yang-084 at [0001], [0002].

As both Zhaung and Yang-084 relate to similar functionality, a person of ordinary skill would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Zhuang with the higher-layer signaling of Yang.

(2) Lee-825 in view of Yang-084

To the extent the references charted in Exhibits J-1–J-8 do not disclose every limitation of the '644 patent, it would have been obvious to combine Lee-825, charted in Exhibit J-6, with Yang-084, charted in Exhibit J-2, each of which discloses and/or renders obvious every claim of the '644 patent, as shown in Exhibits J-6 and J-2. A person of ordinary skill would have been motivated to combine Lee-825 and Yang-084 because they are both in the same field of telecommunications. Specifically, they relate to a method for transmitting and receiving downlink control information. Lee-825 at [0001] ("The present invention relates to wireless

communications, and more particularly, to a method and an apparatus of receiving data in a wirless communication system."); Yang-084 ("The present invention relates to a wireless communication system. More particularly, the present invention relates to a method and apparatus for transmitting/receiving a downlink signal and a method and apparatus for transmitting/receiving an uplink signal.").

A person of ordinary skill would have been motivated to combine Zhuang and Yang-084 because they have similar goals relating to reducing the number of blind decodings which a terminal has to perform. Lee-825 at [0005] ("[F]ast and correct detection of the control information has a significant effect on overall system performance."); Yang-084 at Abstract ("The present invention Exhibits the advantages of reducing the number of [blind decodings] which the UE has to perform and of reducing the implementation complexity of the UE.").

As both Lee-825 and Yang-084 relate to similar functionality, a person of ordinary skill would have been motivated to combine their teachings. Specifically, it would have been obvious to combine the general teachings of Lee-825 with the higher-layer signaling of Yang.

(3) Lee-878 in view of You-420

To the extent the references charted in Exhibits J-1–J-8 do not disclose every limitation of the '644 patent, it would have been obvious to combine Lee-878 charted in Exhibit J-8 with the disclosures of You-420 identified in Appendix J. Both Lee-878 and You-420 are in the same field of telecommunications. Specifically, they relate to a method for transmitting and receiving downlink control information. Lee-878 at [0379] ("The method as in any of the embodiments 1-10 and 18-51, further comprising the WTRU transmitting a hybrid automatic repeat request (HARQ) acknowledgement (ACK) in an uplink subframe n+k on a condition that a downlink subframe n is a subframe containing a physical downlink control channel (PDCCH) associated

with the PDSCH."); You-420 at [0005] ("Since the amount of resources available to the BS for communication with the UE(s) is limited, a new method in which the BS efficiently receives/transmits uplink/downlink data and/or uplink/downlink control information using the limited radio resources is needed."), [0007] ("In an aspect of the present invention, provided herein is a method for receiving a downlink signal by a user equipment, including performing repetitive reception of a physical downlink control channel (PDCCH) during a first subframe bundle including multiple subframes."). Both references also teach about machine-to-machine (M2M) communication. Lee-878 at [0003] ("A communication device, such as a wireless transmit/receive unit (WTRU), may communicate with a remote device via a communication system. The WTRU may be configured to perform machine-to-machine (M2M) or machine-type communications (MTC), which are communications that may be performed without human interaction. This form of communications may have applications in smart metering, home automation, eHealth, fleet management, and other similar environments."); You-420 at [0144] ("Recently, machine type communication (MTC) has come to the fore as a significant communication standard issue. MTC refers to exchange of information between a machine and an eNB without involving persons or with minimal human intervention."), [0002] ("With appearance and spread of machine-to-machine (M2M) communication and a variety of devices such as smartphones and tablet PCs and technology demanding a large amount of data transmission, data throughput needed in a cellular network has rapidly increased."). Lee-878 was filed on October 4, 2013 and claims priority to provisional applications filed on October 5, 2012, January 16, 2013, April 3, 2013, and August 7, 2013. You-420 was filed on August 9, 2016 and claims priority to provisional applications filed on January 14, 2013, April 10, 2013, May 12, 2013, August 6, 2013, September 27, 2013, and October 4, 2013. Thus, both references originate from the same time period.

A person of ordinary skill would have been motivated to combine Lee-878 and You-420 because they have similar goals relating to enhancing coverage for MTC devices. Lee-878 teaches, "A method and apparatus are described for a low cost machine- type-communication (LC-MTC) wireless transmit/receive unit (WTRU) to enhance coverage." Lee-878 at [0005]; *see also id.* at [0081] ("It may be desirable to improve the service coverage of a device or type of device, (for example, an LTE or LTE-Advanced (LTE-A) device), such as a low-cost machine type communication (MTC) (LC-MTC) device by, for example, up to a number of dB, (for example, 15 or 20 dB), as compared to LTE cell coverage which may be defined for other devices which may not be LC-MTC devices."). You-420 teaches, "Recently, machine type communication (MTC) has come to the fore as a significant communication standard issue. MTC refers to exchange of information between a machine and an eNB without involving persons or with minimal human intervention. . . . Since the MTC UE has low mobility, the channel environment thereof remains substantially the same. If an MTC UE is used for metering, reading of a meter, surveillance, and the like, the MTC UE is very likely to be located in a place such as a basement, a warehouse, and mountain regions which the coverage of a typical eNB does not reach. In consideration of the purposes of the MTC UE, it is better for a signal for the MTC UE to have wider coverage than the signal for the conventional UE (hereinafter, a legacy UE)." You-420 at [0144]. As both Lee-878 and You-420 relate to similar functionality, a person of ordinary skill would have been motivated to combine their teachings.

(4) Additional References

To the extent the references charted in Exhibits J-1–J-8 do not disclose "[a] method for receiving, by a terminal, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes," or "a method for transmitting, by a base station,

downlink control information through downlink control channels repeatedly allocated in a plurality of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the other references charted in Exhibits J-1–J-8, each of which discloses this limitation as shown in Exhibits J-1-J-8. A person of skill in the art would be motivated to combine these references because the references all disclose a method for transmitting and receiving downlink control information. *See, e.g.*, Ex. J-1 (Zhuang) at 1[pre], 2[pre]; Ex. J-2 (Yang-084) at 1[pre], 2[pre]; Ex. J-3 (Baker) at 1[pre], 2[pre]; Ex. J-4 (Vajapeyam) at 1[pre], 2[pre]; Ex. J-5 (Lee-668) at 1[pre], 2[pre]; Ex. J-6 (Lee-825) at 1[pre], 2[pre]; Ex. J-7 (Papasakellariou-915) at 1[pre], 2[pre]; Ex. J-8 (Lee-878) at 1[pre], 2[pre]. The '644 patent further admits that various methods were known in the art for transmitting and receiving downlink control information ('644 patent at 6:10-50). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "[a] method for receiving, by a terminal, downlink control information through downlink control channels repeatedly allocated in a plurality of subframes," or "a method for transmitting, by a base station,

downlink control information through downlink control channels repeatedly allocated in a plrulaity of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the references charted in Appendix J, each of which discloses this limitation as shown in Appendix J. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a method for transmitting and receiving downlink control information. *See, e.g.*, Appendix J at 1[pre], 2[pre]. The '644 patent further admits that various methods were known in the art for transmitting and receiving downlink control information ('644 patent at 6:10-50). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "receiving configuration information relating to the plurality of subframes through higher layer signaling," or "transmitting configuration information relating to the plurality of subframes through higher layer signaling," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the other references charted in Exhibits J-1–J-8, each of which discloses this limitation as shown in Exhibits J-1–J-8. A person of skill in the art would be motivated to combine

these references because the references all disclose a communication system that uses higher layer signaling to transmit and receive configuration information. *See, e.g.*, Ex. J-1 (Zhuang) at 1[c]; Ex. J-2 (Yang-084) at 1[c]; Ex. J-3 (Baker) at 1[c]; Ex. J-4 (Vajapeyam) at 1[c]; Ex. J-5 (Lee-668) at 1[c]; Ex. J-6 (Lee-825) at 1[c]; Ex. J-7 (Papasakellariou-915) at 1[c]; Ex. J-8 (Lee-878) at 1[c]. The '644 patent further admits that various methods were known in the art for transmitting and receiving configuration information using higher layer signaling ('644 patent at 5:47-53). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "receiving configuration information relating to the plurality of subframes through higher layer signaling," or "transmitting configuration information relating to the plurality of subframes through higher layer signaling" it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the references charted in Appendix J, each of which discloses this limitation as shown in Appendix J. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose a communication system that uses higher layer signaling to

transmit and receive configuration information. *See, e.g.*, Appendix J at 1[c]. The '644 patent further admits that various methods were known in the art for transmitting and receiving configuration information using higher layer signaling ('644 patent at 5:47-53). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "receiving the downlink control channels repeatedly allocated in a plurality of subframes and combining the received downlink control channels on the basis of the configuration information," or "transmitting the downlink control information through the downlink control channels, repeatedly allocated in the plurality of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the other references charted in Exhibits J-1–J-8, each of which discloses this limitation as shown in Exhibits J-1–J-8. A person of skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Ex. J-1 (Zhuang) at 1[b], 2[b]; Ex. J-2 (Yang-084) at 1[b], 2[b]; Ex. J-3 (Baker) at 1[b], 2[b]; Ex. J-4 (Vajapeyam) at 1[b], 2[b]; Ex. J-5 (Lee-668) at 1[b], 2[b]; Ex. J-6 (Lee-825) at 1[b], 2[b]; Ex. J-7

(Papasakellariou-915) at 1[b], 2[b]; Ex. J-8 (Lee-878) at 1[b], 2[b]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "receiving the downlink control channels repeatedly allocated in a plurality of subframes and combining the received downlink control channels on the basis of the configuration information," or "transmitting the downlink control information through the downlink control channels, repeatedly allocated in the plurality of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the references charted in Appendix J, each of which discloses this limitation as shown in Appendix J. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Appendix J at 1[b], 2[b]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality

of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "extracting the downlink control information from the combined downlink control channels," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the other references charted in Exhibits J-1–J-8, each of which discloses this limitation as shown in Exhibits J-1–J-8. A person of skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Ex. J-1 (Zhuang) at 1[c]; Ex. J-2 (Yang-084) at 1[c]; Ex. J-3 (Baker) at 1[c]; Ex. J-4 (Vajapeyam) at 1[c]; Ex. J-5 (Lee-668) at 1[c]; Ex. J-6 (Lee-825) at 1[c]; Ex. J-7 (Papasakellariou-915) at 1[c]; Ex. J-8 (Lee-878) at 1[c]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas

from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "extracting the downlink control information from the combined downlink control channels," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the references charted in Appendix J, each of which discloses this limitation as shown in Appendix J. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Appendix J at 1[c]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there

were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "the configuration information comprises information on a start subframe of the plurality of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the other references charted in Exhibits J-1–J-8, each of which discloses this limitation as shown in Exhibits J-1–J-8. A person of skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Ex. J-1 (Zhuang) at 1[d], 2[c]; Ex. J-2 (Yang-084) at 1[d], 2[c]; Ex. J-3 (Baker) at 1[d], 2[c]; Ex. J-4 (Vajapeyam) at 1[d], 2[c]; Ex. J-5 (Lee-668) at 1[d], 2[c]; Ex. J-6 (Lee-825) at 1[d], 2[c]; Ex. J-7 (Papasakellariou-915) at 1[d], 2[c]; Ex. J-8 (Lee-878) at 1[d], 2[c]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable

expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "the configuration information comprises information on a start subframe of the plurality of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the references charted in Appendix J, each of which discloses this limitation as shown in Appendix J. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Appendix J at 1[d], 2[c]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "the downlink control information comprises information on the number of the plurality of subframes," it would have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the other references charted in Exhibits J-1–J-8, each of which discloses this limitation as shown in Exhibits J-1–J-8. A person of skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Ex. J-1 (Zhuang) at 1[e], 2[d]; Ex. J-2 (Yang-084) at 1[e], 2[d]; Ex. J-3 (Baker) at 1[e], 2[d]; Ex. J-4 (Vajapeyam) at 1[e], 2[d]; Ex. J-5 (Lee-668) at 1[e], 2[d]; Ex. J-6 (Lee-825) at 1[e], 2[d]; Ex. J-7 (Papasakellariou-915) at 1[e], 2[d]; Ex. J-8 (Lee-878) at 1[e], 2[d]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits J-1–J-8 do not disclose "the downlink control information comprises information on the number of the plurality of subframes," it would

have been obvious to combine any of the references charted in Exhibits J-1–J-8 with any of the references charted in Appendix J, each of which discloses this limitation as shown in Appendix J. A person of ordinary skill in the art would be motivated to combine these references because the references all disclose receiving downlink control channels repeatedly allocated in a plurality of subframes. *See, e.g.*, Appendix J at 1[e], 2[d]. The '644 patent further admits that various methods were known in the art for repeatedly transmitting, to a plurality of subframes, each physical channel's data, which has been repeatedly transmitted only in a unit of one subframe ('644 patent at 8:1-10). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

Moreover, design incentives and other market forces would have prompted these combinations and modifications. Additionally, some prior art references refer to or discuss other prior art references, illustrating the close technical relationship among the prior art references, either expressly or inherently; therefore, it would have been obvious to combine those pieces of prior art for at least that reason.

k) Exemplary Motivation to Combine for the '161 Patent

(1) Huawei 034 in view of Nokia 529

To the extent the references charted in K-1 to K-8 do not disclose every limitation of the '161 Patent, it would have been obvious to combine Huawei 034, charted in Exhibit K-1, with Nokia 529, charted in K-2, each of which discloses and/or renders obvious every claim of the '161 Patent as shown in K-1 and K-2. A person of ordinary skill would have been motivated to combine Huawei 034 and Nokia 529 because they are both in the same field of telecommunications. Specifically, they relate to the same functionality and are directed to the design of a CQI index table that includes CQI values for 256QAM modulation. Huawei 034 at 1 ("In this contribution, . . . the analysis and proposals for the new CQI/MCS table are provided to support 256QAM."); Nokia 529 at 2 ("[W]e present our proposal of the new CQI table in Table 1."). Both references also teach a 256QAM CQI index table with four CQI index values for 256QAM modulation, with a first CQI index value having a code ratex1024 value of 711, and another different CQI index value having a code ratex1024 value of 948. Huawei 034 was circulated for presentation in the February 2014 meeting of RAN WG1, and Nokia 529 was circulated for presentation in the March 2014 meeting of RAN WG1. Thus, both references originate from approximately the same time period, and it would have been obvious to a person of ordinary skill to combine their teachings as they were both related to the ongoing work prior to the earliest supported priority date of the '161 Patent related to the claims 797 code ratex1024 value.

A person of ordinary skill would also have been motivated to combine Huawei 034 and Nokia 529 because they have similar goals relating to the design of the 256QAM CQI indEx. Huawei teaches that, in accordance with the same principles used to design the 64QAM CQI index table, "the CQI entries for 256QAM could be determined using an equal step size in equivalent SNR between 5.5547 and 7.4063." Huawei 034 at 2. Nokia 529 also teaches a 256QAM

CQI index table that maintains equal spacing in SNR between 256QAM CQI index values. *See* Nokia 529 at 2 ("In order to have roughly 2dB granularity, it is good to define two more CQIs (2nd and 3rd 256QAM CQI), with the gap being roughly 5.66/3=1.88dB."). Because each of these references had the same or similar goals, a person of ordinary skill would have been motivated to combine Huawei 034 and Nokia 529 to craft a resulting system or method designed to meet those shared goals.

In particular, a person of ordinary skill in the art would have looked to references like Nokia 529 to more accurately select code rate values capable of meeting the stated goal of equal step size in equivalent SNR between the 256QAM CQI index values of the proposed CQI index table. Huawei 034 admits that it uses a shortcut in determining the code rate values used in its proposed 256QAM CQI index table: "Since the curve of efficiency v. SNR is ***almost*** linear . . . the new CQI entries for 256QAM could be samples based on approximately equal step size in spectral efficiency." Huawei 034 at 2 (emphasis added). A person of ordinary skill would have sought a mapping methodology, such as the BLER curve taught in Nokia 529, to more accurately simulate achieving equal SNR step size between the proposed new 256QAM CQI index values. *See* Nokia 529 at Fig. 2, 3(a)-(b).

To the extent it is argued that Huawei 034 or Nokia 529 do not disclose "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," it would have been obvious to modify their teachings to include "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" in view of the teachings of Nokia 529. A person of

ordinary skill would have understood that implementing this modification would require no more than a software modification to the base station of Huawei 034 and Nokia 529 to update the signaling for the 256QAM CQI index table.

It would also have been obvious to a person of ordinary skill to modify the teachings or Huawei 034 or Nokia 529 in view of the knowledge of a person of ordinary skill in the art. For example, at the time of the purported invention of the '161 Patent, a person of ordinary skill in the art would have been aware of numerous ways of simulating a SNR-BLER curve in a LTE link-level simulator to determine the effective SNR for any given selected code rate value, such as 797/1024. *See generally* Ikuno 2010; Mehlfuhrer 2009 at 5 ("[u]sing the obtained line, an effective SINR can be mapped to a CQI value that is signalled to the eNodeB."); Mehlfuhrer 2011 (describing Vienna LTE Link-Level Simulator); Kitanov at 7 ("To obtain the Block Error Ratio (BLER) and throughput for the [MCS] corresponding to each CQI value, AQGN simulations were performed."), FIG. 3; Vienna LTE Link-Level Simulator. Nokia 529 teaches that its 256QAM CQI index table was designed based on simulations mapping SNR(dB), assuming SISO and AWGN. Nokia 529 at 1 ("[W]e provide simulation results on . . . defining reasonable code rate for each new CQI entry and provide our suggestion for the 256QAM CQI table fulfilling the CQI table design principles agreed in RAN1#76."). And Huawei 034 "provide[s] the link level simulations . . . to evaluate the BLER of the same spectral efficiency." Huawei 034 at 3. Huawei 034 also teaches that "the CQI entries for 256QAM could be determined using an equal step size in equivalent SNR between 5.5547 and 7.4063." Huawei 034 at 2. As does Nokia: Nokia 529 also "In order to have roughly 2dB granularity, it is good to define two more CQIs (2nd and 3rd 256QAM CQI), with the gap being roughly 5.66/3=1.88dB." A person of ordinary skill would have understood there is a finite number of code ratex1024 values that comply with design principles agreed upon by the

RAN1 WG1 and that are capable of yielding equal step size in equivalent SNR between spectral efficiency values of 5.5547 and 7.4063, which correspond to code ratex1024 values of 711 and 948 for their respective 256QAM CQI index tables.

These combinations and modifications described above would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

The resulting combination of Huawei 034 with Nokia 529 or modification of Huawei 034 and/or Nokia 529 would not require excessive modifications to the systems or methods taught by the references. For example, the techniques, systems, and methods taught by Nokia 529 could be implemented via software modifications to Huawei 034's signaled CQI index table. Even to the extent these references do not explicitly note implementation via software, a person of ordinary skill would understand and have found it obvious to implement the techniques and methods disclosed therein within the resulting combination. As such, extensive modification of Huawei 034 would not have been required to achieve the resulting combination. *See, e.g.*, Larsson 091 Provisional at 3:26-27 ("The implementation effort in eNB and UEs is kept to a minimum by sharing the majority entries of Rel-8 MCS/CQI/TBS tables and the proposed ones.").

(2) Xia 681 in view of Huawei 034

To the extent the references charted in K-1 to K-8 do not disclose every limitation of the '161 Patent, it would have been obvious to combine Xia 681, charted in Exhibit K-3, with Nokia

529, charted in K-1, each of which discloses and/or renders obvious every claim of the '161 Patent as shown in K-3 and K-1. A person of ordinary skill would have been motivated to combine Xia 681 and Huawei 034 because they are both in the same field of telecommunications. Specifically, they relate to the same functionality and are directed to the design of a CQI index table that includes CQI values for 256QAM modulation. *See, e.g.*, Xia 681 at Table 6-3 (256QAM CQI index table); Huawei 034 at 1 ("In this contribution, . . . the analysis and proposals for the new CQI/MCS table are provided to support 256QAM."). Both references also teach a 256QAM CQI index table with four CQI index values for 256QAM modulation, with a first CQI index value having a code ratex1024 value of 711, and another different CQI index value having a code ratex1024 value of 948. Huawei 034 was circulated for presentation in the February 2014 meeting of RAN WG1, and Xia 681 was filed on January 23, 2014. Thus, both references originate from approximately the same time period, and it would have been obvious to a person of ordinary skill to combine their teachings. Moreover, the inventors of Xia 681 were employees of Huawei Technologies Co., Ltd. ("Huawei"), and Huawei 034 was submitted by Huawei. Thus, it would have been obvious to look to the publications of individuals employed by the same company to find related publications.

To the extent it is argued that Xia 681 or Huawei 034 do not disclose "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," it would have been obvious to modify their teachings to include "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" in view of the teachings of Huawei 034. A person of ordinary skill would have understood that implementing this modification would require no more

than a software modification to the base station of Xia 681 and Huawei 034 to update the signaling for the 256QAM CQI index table.

It would also have been obvious to a person of ordinary skill to modify the teachings or Xia 681 or Huawei 034 in view of the knowledge of a person of ordinary skill in the art. For example, at the time of the purported invention of the '161 Patent, a person of ordinary skill in the art would have been aware of numerous ways of simulating a SNR-BLER curve in a LTE link-level simulator to determine the effective SNR for any given selected code rate value, such as 797/1024. *See generally* Ikuno 2010; Mehlfuhrer 2009 at 5 ("[u]sing the obtained line, an effective SINR can be mapped to a CQI value that is signalled to the eNodeB."); Mehlfuhrer 2011 (describing Vienna LTE Link-Level Simulator); Kitanov at 7 ("To obtain the Block Error Ratio (BLER) and throughput for the [MCS] corresponding to each CQI value, AQGN simulations were performed."), FIG. 3; Vienna LTE Link-Level Simulator. Huawei 034 "provide[s] the link level simulations . . . to evaluate the BLER of the same spectral efficiency." Huawei 034 at 3. Xia 681 also teaches that "the specific value" of its proposed new TBS table entries "can be set according to the simulation result." Xia 681 at 136. A person of ordinary skill would have understood there is a finite number of code ratex1024 values that comply with design principles capable of yielding equal step size in equivalent SNR between spectral efficiency values of 5.5547 and 7.4063, which correspond to code ratex1024 values of 711 and 948 for their respective 256QAM CQI index tables.

These combinations and modifications described above would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from

prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

The resulting combination of Xia 681 with Huawei 034 or modification of Xia 681 and/or Huawei 034 would not require excessive modifications to the systems or methods taught by the references. Even to the extent these references do not explicitly note implementation via software, a person of ordinary skill would understand and have found it obvious to implement the techniques and methods disclosed therein within the resulting combination. As such, extensive modification of Huawei 034 and Xia 681 would not have been required to achieve the resulting combination and/or modification. *See, e.g.*, Larsson 091 Provisional at 3:26-27 ("The implementation effort in eNB and UEs is kept to a minimum by sharing the majority entries of Rel-8 MCS/CQI/TBS tables and the proposed ones.").

(3) Kwon 630 in view of Huawei 034

To the extent the references charted in K-1 to K-8 do not disclose every limitation of the '161 Patent, it would have been obvious to combine Kwon 630, charted in Exhibit K-6, with Huawei 034, charted in Exhibit K-1, each of which discloses and/or renders obvious every claim of the '161 Patent as shown in K-6 and K-1. A person of ordinary skill would have been motivated to combine Kwon 630 and Huawei 034 because they are both in the same field of telecommunications. Specifically, they relate to the same functionality and are directed to the design of a CQI index table that includes CQI values for 256QAM modulation. Kwon 630 at Table 6; Huawei 034 at 1 ("In this contribution, . . . the analysis and proposals for the new CQI/MCS table are provided to support 256QAM."). Both references also teach a 256QAM CQI index table with four CQI index values for 256QAM modulation, with a first CQI index value having a code

ratex1024 value of 711. Huawei 034 was circulated for presentation in the February 2014 meeting of RAN WG1, and Kwon 630 claims priority to a provisional application (No. 61/924,194) filed on January 6, 2014. Thus, both references originate from approximately the same time period, and it would have been obvious to a person of ordinary skill to combine their teachings.

These combinations described above would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

The resulting combination of Kwon 630 and Huawei 034 would not require excessive modifications to the systems or methods taught by the references. For example, the techniques, systems, and methods taught by Kwon 630 could be implemented via software modifications to Huawei 034's signaled CQI index table. Even to the extent these references do not explicitly note implementation via software, a person of ordinary skill would understand and have found it obvious to implement the techniques and methods disclosed therein within the resulting combination. As such, extensive modification of Huawei 034 or Kwon 630 would not have been required to achieve the resulting combination. *See, e.g.*, Larsson 091 Provisional at 3:26-27 ("The implementation effort in eNB and UEs is kept to a minimum by sharing the majority entries of Rel-8 MCS/CQI/TBS tables and the proposed ones.").

(4) Additional References

To the extent the references charted in Exhibits K-1–K-8 do not disclose "[a] method for transmitting channel state information by a User Equipment (UE)," a "method for receiving

channel state information by a base station," or a "User Equipment (UE) for transmitting channel state information," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K-1–K-8. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting channel state information by a UE. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[pre], 3[pre], 5[pre]; Ex. K-2 (Nokia 529) at 1[pre], 3[pre], 5[pre]; Ex. K-3 (Xia 681) at 1[pre], 3[pre], 5[pre]; Ex. K-4 (Chen 732) at 1[pre], 3[pre], 5[pre]; Ex. K-5 (Larsson 091) at 1[pre], 3[pre], 5[pre]; Ex. K-6 (Kwon 630) at 1[pre], 3[pre], 5[pre]; Ex. K-7 (Huawei 120) at 1[pre], 3[pre], 5[pre]; Ex. K-8 (TS 36.213) at 1[pre], 3[pre], 5[pre]. The '161 patent further admits that various methods were known in the art for transmitting channel state information ('161 patent at 1:65-67 ("the terminal measures the downlink channel state, and transmits information on the measured channel state to the base station")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "[a] method for transmitting channel state information by a User Equipment (UE)," a "method for receiving

channel state information by a base station," or a "User Equipment (UE) for transmitting channel state information," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting channel state information by a UE. *See, e.g.*, Appendix K at 1[pre], 3[pre], 5[pre]. The '161 patent further admits that various methods were known in the art for transmitting channel state information ('161 patent at 1:65-67 ("the terminal measures the downlink channel state, and transmits information on the measured channel state to the base station")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "receiving a reference signal for measuring channel quality from a base station," "creating a reference signal for measuring channel quality," "transmitting the reference signal to a User Equipment (UE)," "a receiver configured to receive a reference signal for measuring channel quality from a base station," "measuring the channel quality based on the reference signal," or "a controller configured

to measure the channel quality based on the reference signal," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K-1–K-8. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting and receiving channel measurement signals. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-2 (Nokia 529) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-3 (Xia 681) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-4 (Chen 732) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-5 (Larsson 091) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-6 (Kwon 630) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-7 (Huawei 120) at 1[a], 1[b], 3[a], 5[a], 5[b]; Ex. K-8 (TS 36.213) at 1[a], 1[b], 3[a], 5[a], 5[b]. The '161 patent further admits that various methods were known in the art for measuring channel quality ('161 patent at 1:65-67 ("the terminal measures the downlink channel state, and transmits information on the measured channel state to the base station")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "receiving a reference signal for measuring channel quality from a base station," "creating a reference signal

for measuring channel quality," "transmitting the reference signal to a User Equipment (UE)," "a receiver configured to receive a reference signal for measuring channel quality from a base station," "measuring the channel quality based on the reference signal," or "a controller configured to measure the channel quality based on the reference signal," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting and receiving channel measurement signals. *See, e.g.*, Appendix K at 1[a], 1[b], 3[a], 5[a]. The '161 patent further admits that various methods were known in the art for measuring channel quality ('161 patent at 1:65-67 ("the terminal measures the downlink channel state, and transmits information on the measured channel state to the base station")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," receiving a "(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," or 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," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K-1–K-8. A person of skill in the art would be motivated to combine these references because the references all disclose selecting a CQI index value from a 256QAM CQI index table. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[b], 3[c], 5[b]; Ex. K-2 (Nokia 529) at 1[b], 3[c], 5[b]; Ex. K-3 (Xia 681) at 1[b], 3[c], 5[b]; Ex. K-4 (Chen 732) at 1[b], 3[c], 5[b]; Ex. K-5 (Larsson 091) at 1[b], 3[c], 5[b]; Ex. K-6 (Kwon 630) at 1[b], 3[c], 5[b]; Ex. K-7 (Huawei 120) at 1[b], 3[c], 5[b]; Ex. K-8 (TS 36.213) at 1[b], 3[c], 5[b]. The '161 patent further admits that various methods were known in the art for selecting a CQI index from a CQI index table ('161 patent at 1:67-2:3 ("At this time, the terminal transmits CQI information included in the channel state information signal . . . .")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from

prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," receiving a "(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," or 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," it would have been obvious to combine any of the references charted in K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose selecting a CQI index value from a 256QAM CQI index table. *See, e.g.*, Appendix K at 1[b], 3[c], 5[b]. The '161 patent further admits that various methods were known in the art for selecting a CQI index from a CQI index table ('161 patent at 1:67-2:3 ("At this time, the terminal transmits CQI information included in the channel state information signal . . . ."')). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination

of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "transmitting channel state information including the selected CQI index value to the base station," "receiving channel state information including a channel quality indicator (CQI) index," or "a transmitter configured to transmit channel state information including the selected CQI index value to the base station," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K-1–K-8. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting a selected CQI index value. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[c], 3[c], 5[c]; Ex. K-2 (Nokia 529) at 1[c], 3[c], 5[c]; Ex. K-3 (Xia 681) at 1[c], 3[c], 5[c]; Ex. K-4 (Chen 732) at 1[c], 3[c], 5[c]; Ex. K-5 (Larsson 091) at 1[c], 3[c], 5[c]; Ex. K-6 (Kwon 630) at 1[c], 3[c], 5[c]; Ex. K-7 (Huawei 120) at 1[c], 3[c], 5[c]; Ex. K-8 (TS 36.213) at 1[c], 3[c], 5[c]. The '161 patent further admits that various methods were known in the art for transmitting and receiving a CQI index value ('161 patent at 1:67-2:3 ("At this time, the terminal transmits CQI information included in the channel state information signal . . . .")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a

combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "transmitting channel state information including the selected CQI index value to the base station," "receiving channel state information including a channel quality indicator (CQI) index," or "a transmitter configured to transmit channel state information including the selected CQI index value to the base station," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose transmitting a selected CQI index value. *See, e.g.*, Appendix K at 1[c], 3[c], 5[c]. The '161 patent further admits that various methods were known in the art for transmitting and receiving a CQI index value ('161 patent at 1:67-2:3 ("At this time, the terminal transmits CQI information included in the channel state information signal . . . .")). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been

a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K-1–K-8. A person of skill in the art would be motivated to combine these references because the references all disclose the design of a 256QAM index table. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[d], 3[d], 5[d]; Ex. K-2 (Nokia 529) at 1[d], 3[d], 5[d]; Ex. K-3 (Xia 681) at 1[d], 3[d], 5[d]; Ex. K-4 (Chen 732) at 1[d], 3[d], 5[d]; Ex. K-5 (Larsson 091) at 1[d], 3[d], 5[d]; Ex. K-6 (Kwon 630) at 1[d], 3[d], 5[d]; Ex. K-7 (Huawei 120) at1[d], 3[d], 5[d]; Ex. K-8 (TS 36.213) at 1[d], 3[d], 5[d]. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table ('161 patent at page 2 (citing references disclosing a 256QAM index table with the claimed arrangement of modulation orders)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been

a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose the design of a 256QAM index table. *See, e.g.*, Appendix K at 1[d], 3[d], 5[d]. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table ('161 patent at page 2 (citing references disclosing a 256QAM index table with the claimed arrangement of modulation orders)). It is the nature of the communications field such as this to combine ideas 357ifferrent references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying

known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," or "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,'" it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K-1–K-8. A person of skill in the art would be motivated to combine these references because the references all disclose the design of a 256QAM CQI index table. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; K2 (Nokia 529) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; Ex. K-3 (Xia 681) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; Ex. K-4 (Chen 732) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; Ex. K-5 (Larsson 091) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; Ex. K-6 (Kwon 630) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; Ex. K-7 (Huawei 120) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]; Ex. K-8 (TS 36.213) at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table with the claimed spectral efficiency and code rate values ('161 patent at page 2 (citing publications disclosing the claimed values)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try

given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," or "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,'" it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose the design of a 256QAM CQI index table. *See, e.g.*, Appendix K at 1[e], 1[g], 3[e], 3[g], 5[e], 5[g]. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table with the claimed spectral efficiency and code rate values ('161 patent at page 2 (citing publications disclosing the claimed values)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there

would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," or "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,'" it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K1–K8. A person of skill in the art would be motivated to combine these references because the references all disclose a method for designing a 256QAM CQI index table. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-2 (Nokia 529) at1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-3 (Xia 681) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-4 (Chen 732) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-5 (Larsson 091) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-6 (Kwon 630) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-7 (Huawei 120) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]; Ex. K-8 (TS 36.213) at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table ('161 patent at pate 2 (citing numerous publications relating to 256QAM CQI index table design)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions

taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," or "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,'" it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose a method for designing a 256QAM CQI index table. *See, e.g.*, Appendix K at 1[f], 1[h], 3[f], 3[h], 5[f], 5[h]. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table ('161 patent at page 2 (citing numerous publications relating to 256QAM CQI index table design)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a

combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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,'" it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which renders this limitation obvious as shown in K1–K8. A person of skill in the art would be motivated to combine these references because the references all disclose the design rationale of a 256QAM CQI index table. *See, e.g.*, Ex. K-1 (Huawei 034) at 1[i], 3[i], 5[i]; Ex. K-2 (Nokia 529) at 1[i], 3[i], 5[i]; Ex. K-3 (Xia 681) at 1[i], 3[i], 5[i]; Ex. K-4 (Chen 732) at 1[i], 3[i], 5[i]; Ex. K-5 (Larsson 091) at 1[i], 3[i], 5[i]; Ex. K-6 (Kwon 630) at 1[i], 3[i], 5[i]; Ex. K-7 (Huawei 120) at 1[i], 3[i], 5[i]; Ex. K-8 (TS 36.213) at 1[i], 3[i], 5[i]. The '161 patent further admits that various methods were known in the art for designing 256QAM CQI index tables ('161 patent at page 2 (citing numerous publications relating to 256QAM CQI table design)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try

given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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,'" it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which renders this limitation obvious as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose the design rationale of a 256QAM CQI index table. *See, e.g.*, Appendix K at 1[i], 3[i], 5[i]. The '161 patent further admits that various methods were known in the art for designing 256QAM CQI index tables ('161 patent at page 2 (citing numerous publications relating to 256QAM CQI table design)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations

would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Exhibits K-1–K-8, each of which discloses this limitation as shown in K1–K8. A person of skill in the art would be motivated to combine these references because the references all disclose designs for 256QAM CQI index tables. *See, e.g.*, Ex. K-1 (Huawei 034) at 2; Ex. K-2 (Nokia 529) at 2; Ex. K-3 (Xia 681) at 2; Ex. K-4 (Chen 732) at 2; Ex. K-5 (Larsson 091) at 2; Ex. K-6 (Kwon 630) at 2; Ex. K-7 (Huawei 120) at 2; Ex. K-8 (TS 36.213) at 2. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table ('161 patent at pate 2 (citing numerous publications relating to 256QAM CQI index table design)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

To the extent the references charted in Exhibits K-1–K-8 do not disclose "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," it would have been obvious to combine any of the references charted in Exhibits K-1–K-8 with any of the other references charted in Appendix K, each of which discloses this limitation as shown in Appendix K. A person of skill in the art would be motivated to combine these references because the references all disclose designs for 256QAM CQI index tables. *See, e.g.*, Appendix K at cls. 2, 4, 6. The '161 patent further admits that various methods were known in the art for designing a 256QAM CQI index table ('161 patent at pate 2 (citing numerous publications relating to 256QAM CQI index table design)). It is the nature of the communications field such as this to combine ideas from different references to achieve the best solution. Accordingly, a person of ordinary skill in the art would be motivated to combine the above-identified references, and variations thereof, to identify acceptable solutions taking into account cost, efficiency, and complexity. These combinations would also have been a combination of prior art elements according to known methods and obvious to try given that there were a finite number of identified, predictable solutions in the prior art, and there would have been a reasonable expectation of success to simply implement one prior art solution with concepts from prior art in the same field. Moreover, these combinations would have been the result of applying known techniques to a known method—that was ready for improvement—to yield predictable results.

l) Statement Regarding Exemplary Obviousness Combinations and Motivations to Combine

The suggested obviousness combinations discussed herein are not to be construed to suggest that any reference included in the combinations is not anticipatory. Further, to the extent that Pegasus contends that any of the anticipatory prior art fails to disclose one or more limitations

of the Asserted Claims, Defendants reserve the right to identify other prior art references that, when combined with the anticipatory prior art, would render the claims obvious despite an allegedly missing limitation. Defendants will further specify the motivations to combine the prior art, including through reliance on expert testimony, at the appropriate later stage of this lawsuit.

The Supreme Court in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), recognized that patents based on new combinations of elements or components already known in a technical field may be found to have been obvious. The Supreme Court rejected a rigid application of the "teaching, suggestion, or motivation [to combine]" test. *Id*. at 415, 419. "In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. What matters is the objective reach of the claim." *Id*. at 419. "Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id*. at 420. The Supreme Court emphasized the principle that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id*. at 416. A key inquiry is whether the "improvement is more than the predictable use of prior art elements according to their established function." *Id*. at 417.

The Court further held that "in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id. at* 420. It is sufficient that a combination of elements was "obvious to try"—"When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense." *Id. at* 421. "In that instance the fact that a combination was obvious to try

might show that it was obvious under § 103." *Id*. Finally, the Supreme Court recognized that "[g]ranting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known elements, deprive prior inventions of their value or utility." *Id*. at 419.

The rationale to combine or modify prior art references is significantly stronger when the references seek to solve the same problem, come from the same field, and correspond well together. *See In re Inland Steel Co.*, 265 F.3d 1354, 1362 (Fed. Cir. 2001) (allowing two references to be combined as invalidating art under similar circumstances where the art "focus[ed] on the same problem ... c[a]me from the same field of art [and] ... the identified problem found in the two references correspond[ed] well").

All of the following rationales recognized in *KSR* support a finding of obviousness with respect to each of the obviousness combinations disclosed herein: (1) combining prior art elements according to known methods to yield predictable results; (2) simple substitution of one known element for another to obtain predictable results; (3) use of a known technique to improve similar devices, methods, or products in the same way; (4) applying a known technique to a known device, method, or product ready for improvement to yield predictable results; (5) "obvious to try," that is, choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (6) known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and (7) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention. Certain of these rationales are discussed more specifically above. The fact that other rationales are not

discussed more specifically should not be interpreted as an admission or concession that the other rationales do not apply.

Multiple teachings, suggestions, motivations, and/or reasons to modify any of the references and/or to combine two or more of the prior art references set forth herein come from many sources, including the prior art itself (individual references and as a whole), common knowledge, common sense, predictability, expectations, industry trends, design incentives or need, market demand or pressure, market forces, obviousness to try, the nature of the problem faced, and/or knowledge possessed by a person of ordinary skill. Defendants reserve the right to present expert testimony on, among other things, the teachings, suggestions, motivations, and/or reasons to modify any of the references and/or to combine any two or more of the prior art references presented in Exhibits A-1–A-15, Exhibits B-1–B-9, Exhibits C-1–C-6, Exhibits EXHIBITS D-1–D-9, Exhibits E-1–E7, Exhibits F-1–F-13, Exhibits G-1–G-16, Exhibits H-1–H-16, Exhibits I-1–I-7, Exhibits J-1–J-8, and Exhibits K-1–K-8, and/or Appendices A–K.

Defendants further contend that the prior art identified in these Amended Invalidity Contentions is evidence of simultaneous or near-simultaneous independent invention by others of the alleged invention as recited in one or more of the Asserted Claims. Defendants reserve their rights to rely on the simultaneous or near-simultaneous independent invention by others as further evidence of the obviousness of the Asserted Claims.

Each limitation of the Asserted Claims was well-known to those of ordinary skill in the art at the time. At best, the elements recited in the Asserted Claims are mere combinations and modifications of these well-known elements. A person of ordinary skill in the art would be able, and motivated, to improve the existing technology in the same or similar manner by combining or modifying the individual elements that were already known in the art to yield predictable results.

3. Secondary Considerations

A patentee bears the burden of production with respect to evidence of secondary considerations of non-obviousness. *ZUP, LLC v. Nash Mfg., Inc.*, 896 F.3d 1365, 1373 (Fed. Cir. 2018). As of the date of these Amended Invalidity Contentions, Pegasus has not yet identified any evidence of secondary considerations. Defendants reserve all rights to further respond to any secondary considerations of non-obviousness raised by Pegasus, including by updating, modifying, and/or adding to these Amended Invalidity Contentions. Defendants are not aware of any unexpected results, long felt need, commercial success (or any nexus to any allegedly successful commercial embodiment), or awards for the alleged inventions of the Asserted Patents. For example, as described in detail above, the purported problem and proposed solution identified by each of the Asserted Patents were taught by multiple references.

E. P.R. 3-3(d) – Invalidity Under 35 U.S.C. § 112

As set forth below, Defendants contend that the Asserted Claims are invalid under 35 U.S.C. § 112 because the claims (1) are indefinite; (2) fail to satisfy the enablement requirement; and/or (3) fail to satisfy the written description requirement.

Defendants' invalidity contentions for the Asserted Claims identified in this section are made in the alternative and do not constitute, and should not be interpreted as, admissions regarding the construction or scope of the Asserted Claims identified herein or that any of the Asserted Claims identified herein would not have been anticipated and/or obvious in light of the prior art.

Pegasus has not yet provided a claim construction for any of the terms or phrases that Defendants anticipate will be in dispute. Defendant, therefore, cannot provide a complete list of § 112 defenses, because Defendants do not know whether Pegasus will proffer a construction for certain terms and phrases that is broader than, or inconsistent with, the construction that would be

supportable by the disclosure set forth in the specification. Defendants offer these contentions without any prejudice to any position they may ultimately take as to any claim construction issues.

Accordingly, Defendants reserve the right to supplement, amend, and/or modify these § 112 invalidity contentions as discovery progresses.

1. Invalidity Under 35 U.S.C. § 112(a)

Section 112(a) requires that the specification contain a written description of the invention. "[T]he hallmark of written description is disclosure." *Boston Scientific Corp. v. Johnson & Johnson*, 647 F.3d 1353, 1361–62 (Fed. Cir. 2011) (citation omitted). The test for whether a specification adequately describes an invention is "whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date . . . . [T]he test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art .... [It] is a question of fact." *Ariad Pharms., Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*); *Boston Scientific*, 647 F.3d at 1362.

The enablement requirement of § 112 demands that the patent specification enable "those skilled in the art to make and use the full scope of the claimed invention without 'undue experimentation.'" *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1365 (Fed. Cir. 1997) (quoting *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993)). "[T]he scope of the claims must be less than or equal to the scope of the enablement." *Nat'l Recovery Tech., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999).

"The AIA did not make any substantive change to § 112; therefore, the analysis is identical under both versions." *In re Maatita*, 900 F.3d 1369, 1372 n.1 (Fed. Cir. 2018).

Defendants contend that the following Asserted Claims are invalid under 35 U.S.C. § 112(a). Each Asserted Claim identified below (and each Asserted Claim that depends therefrom)

is invalid under § 112(a) because the specification of the Asserted Patent fails to provide a sufficient written description, enabling disclosure, and/or fails to inform, with reasonable certainty, those skilled in the art the manner and process of making and using the same. For each listed term or phrase, Defendants believe the term or phrase is invalid under § 112(a), as is any limitation including such terms or phrases, for the same reason(s).

Asserted Patent	Asserted Claim(s)	Term(s) and/or Phrase(s) Lacking Written Description and Enablement
'631 patent	1	"deciding, by a source base station (BS), whether to perform a handover"
'631 patent	7	"to decide whether to perform a handover"
'631 patent	13	"a controller configured to decide whether to perform a handover"
'631 patent	1, 7, 13	"wherein, if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by the target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS"
'931 patent	1, 3, 5, and 7	"start offset information on the resource allocated to the uplink control channel is determined based on a coverage level"
'931 patent	2, 4, and 6	"at least one of the plurality of pieces of start offset information is applied according to a corresponding coverage level"
'931 patent	1, 3, and 7	"the resource allocated to the uplink control channel is determined based on at least one of: i) information on a resource of a downlink control channel for scheduling the downlink data; ii) the information on the resource allocated to the uplink control channel; and iii) the start offset information on the resource allocated to the uplink control channel"

Asserted Patent	Asserted Claim(s)	Term(s) and/or Phrase(s) Lacking Written Description and Enablement
'931 patent	5	"determine a resource allocated to the uplink control channel for transmitting the response information of the downlink data based on at least one of i) information on a resource of a downlink control channel for scheduling the downlink data, ii) the information on the resource allocated to the uplink control channel, and iii) the start offset information on the resource allocated to the uplink control channel"
'931 patent	1	"configured separated from start offset information for a terminal different from the MTC terminal"
'931 patent	3, 5, 7	"configured separated from offset information for a terminal different from the MTC terminal"
'931 patent	1, 3, 5, and 7	"a plurality of pieces of start offset information of the resource allocated to the uplink control channel are provided"
'931 patent	1 and 5	"the plurality of pieces of start offset information are received through cell-specific high layer signaling"
'931 patent	3 and 7	"the plurality of pieces of start offset information are transmitted through cell-specific high layer signaling"
'931 patent	1, 3, 5, 7	"using a same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted"
'932 patent	1	"receiving an uplink radio resource control (RRC) message from a terminal, including the uplink RRC message into a first message, and transmitting the first message to a central unit"
'932 patent	1	"receiving a second message from the central unit, where the second message includes a downlink RRC message in response to the uplink RRC message from the terminal"
'932 patent	1	"transmitting the downlink RRC message to the terminal"
'932 patent	1, 8	"the access unit and the central unit distinguish signaling radio bearers based on radio bearer identification information-included in the first message and the second message"
'932 patent	8	"a transmitter configured to transmit a first message to a central unit, where the first message includes an uplink RRC message received from a terminal"

Asserted Patent	Asserted Claim(s)	Term(s) and/or Phrase(s) Lacking Written Description and Enablement
'932 patent	8	"a receiver configured to receive a second message from the central unit, where the second message includes a downlink RRC message in response to the uplink RRC message from the terminal"
'932 patent	8	"wherein the transmitter transmits the downlink RRC message to the terminal"
'942 patent	1, 5, 9	"prior slot"
'942 patent	1, 5, 9	"specific RNTI"
'942 patent	1, 5, 9	"newly defined RNTI"
'942 patent	1, 5, 9	"monitoring"
'942 patent	1, 5, 9	"downlink (DL) preemption information"
'942 patent	1, 5, 9	"multicast signal"
'942 patent	2, 6, 10	"subcarrier spacing"
'942 patent	2, 6, 10	"time-domain scheduling unit"
'942 patent	3, 7, 11	"common search space"
'942 patent	3, 7, 11	"DL control channel"
'460 patent	1, 5, 9,	"bandwidth part (BWP) configuration information"
'460 patent	1, 5, 9,	"BWP set"
'460 patent	1, 5, 9,	"frequency hopping configuration information"
'460 patent	1, 5, 9,	"one transmission BWP of the BWP set"
'460 patent	1, 5, 9,	"frequency hopping offset set composed of one or more frequency hopping offset values"
'460 patent	2, 6, 10	"physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel"
'460 patent	3, 7, 11	"a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP"
'460 patent	4, 8, 12	"the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less"

Asserted Patent	Asserted Claim(s)	Term(s) and/or Phrase(s) Lacking Written Description and Enablement
'118 patent	1	"receiving from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB"
'118 patent	1	"transmitting a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message"
'118 patent	1, 10	"wherein the addition of the secondary base station SRB is determined by the secondary base station"
'118 patent	2, 8, 11	"wherein the master base station and the second base station are base stations using radio access technologies different from each other
'118 patent	3, 12	"the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure"
'118 patent	6	"the failure information message includes cause information on the secondary base station radio resource configuration failure."
'118 patent	7	"determining, by the secondary base station, to add a secondary base station signaling radio bearer (SRB) to the user equipment"
'118 patent	7	"a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group to the user equipment through the secondary base station SRB"
'118 patent	7	"a response message for a radio resource configuration from the user equipment through the secondary BS SRB if the UE successfully complies with a radio resource on the secondary base station"
'118 patent	7	"the user equipment configures dual connectivity by using a master base station and the secondary base station"
'118 patent	9	"in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station"

Asserted Patent	Asserted Claim(s)	Term(s) and/or Phrase(s) Lacking Written Description and Enablement
’118 patent	10	“a controller configured to add and configure a secondary base station signaling radio bearer (SRB)”
’118 patent	10	“a receiver configured to receive from a secondary base station, a radio resource control (RRC) message including radio resource configuration information on the secondary base station or a secondary cell group through the secondary base station SRB”
’118 Patent	10	“a transmitter configured to transmit a failure information message to a master base station in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message”
’000 patent	1, 4, 5, 8, 9, 12	uplink (UL) control information
’000 patent	1, 5, 9	UL control channel resource set configuration information
’000 patent	1, 5, 9	wherein . . . the one of the UL control channel resource sets is performed based on a size of the UL control information
’000 patent	1, 5, 9	UE specific radio resource (RRC) signaling
’000 patent	3, 4, 7, 8, 11, 12	downlink (DL) control information
’000 patent	9	a receiver configured to receive
’000 patent	9	a controller configured to determine
’000 patent	9	a transmitter configured to transmit
’463 patent	1, 2, 3, 4, 5, 6, 7, 8, 9	uplink (UL) control information
’463 patent	1, 4, 7	UL control channel resource set configuration information
’463 patent	2, 5, 8	wherein . . . the one of the UL control channel resource sets is performed based on a size of the UL control information
’463 patent	1, 3, 4, 6, 7, 9	downlink (DL) control information
’463 patent	7	a receiver configured to receive
’463 patent	7	a controller configured to determine
’463 patent	7	a transmitter configured to transmit
’272 patent	1, 8, 15	“Radio resource control (RRC) information”
’272 patent	1, 8, 15	“row index of an allocation table”
’272 patent	1, 8, 15	“a number of OFDM symbols are determined for a physical downlink shared channel (PDSCH) or a physical uplink shared channel (PUSCH)”

Asserted Patent	Asserted Claim(s)	Term(s) and/or Phrase(s) Lacking Written Description and Enablement
'272 patent	1, 8, 15	"the determined number of OFDM symbols"
'272 patent	1, 8, 15	"allocation table"
'272 patent	2, 9, 16	"bit string"
'272 patent	5, 12, 19	"numerologies"
'272 patent	5, 12, 19	"subcarrier spacing (SCS)"
'644 patent	1, 2, 3	"downlink control channels repeatedly allocated in a plurality of subframes"
'644 patent	1, 3	"combining the received downlink control channels on the basis of the configuration information" / "configured to combine the received downlink control channels based on the configuration information"
'644 patent	1, 3	"extracting the downlink control information from the combined downlink control channels" / "configured to extract downlink control information from the combined downlink control channels"
'644 patent	1, 2, 3	"information on a start subframe of the plurality of subframes"
'644 patent	1, 2, 3	"information on the number of the plurality of subframes"
'644 patent	1	"receiving configuration information … through higher layer signaling"
'644 patent	2	"transmitting configuration information … through higher layer signaling"
'644 patent	3	"a receiver configured to receive configuration information … through higher layer signaling"
'161 patent	1-6	"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"
'161 patent	2, 4, 6	"to have same difference within a predetermined error rate"

2. Invalidity Under 35 U.S.C. § 112(b)

Claims are indefinite under 35 U.S.C. § 112(b) when they "fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 34 S. Ct. 2120, 2124 (2014). To the extent an asserted apparatus claim includes

both apparatus and method limitations, that claim is invalid for indefiniteness under § 112(b) because it fails to identify or notify the public of what constitutes direct infringement. *See IPXL Holdings, L.L.C. v. Amazon.com, Inc.*, 430 F.3d 1377 (Fed. Cir. 2005).

"The AIA did not make any substantive change to § 112; therefore, the analysis is identical under both versions." *In re Maatita*, 900 F.3d 1369, 1372 n.1 (Fed. Cir. 2018).

In addition to Defendants' reservation of rights stated above, Defendants will present arguments as to indefiniteness will be presented at that time, *i.e.*, through the *Markman* meet and confer and briefing process.

Defendants contend that the following Asserted Claims are invalid under 35 U.S.C. § 112(b). Each Asserted Claim identified below (and each Asserted Claim that depends therefrom) is invalid under § 112(b) because they fail to inform, with reasonable certainty, those skilled in the art about the scope of the claimed invention. For each listed term or phrase, Defendants believe the term or phrase (as well as terms within any such phrase) is invalid under § 112(b), and any limitation including such term or phrase is also indefinite.

Asserted Patent	Asserted Claim(s)	Indefinite Term(s) and/or Phrase(s)
'631 patent	7	"A controller for transmitting and receiving data"
'631 patent	7	"a processor performs"
'631 patent	7	"to decide whether to perform a handover"
'631 patent	7	"to transmit a handover request message when it is decided to perform the handover"
'631 patent	7	"wherein the handover request message includes network slice information"
'631 patent	7	"to receive a handover request confirmation message in response to the handover request message"
'631 patent	7	"wherein, if one or more protocol data unit (PDU) sessions are associated with one or more network slices that are not supported by a target BS, the handover request confirmation message includes information for indicating a rejection of the one or more PDU sessions by the target BS"

Asserted Patent	Asserted Claim(s)	Indefinite Term(s) and/or Phrase(s)
'631 patent	14, 15	"the processor"
'931 patent	1, 3, 5, 7	"transmitting response information of downlink data"
'931 patent	1, 3, 5, 7	"of downlink data"
'931 patent	1	"on the downlink data"
'931 patent	1-7	"coverage level"
'931 patent	1, 3, 5, 7	"structural information"
'931 patent	1, 3, 5, 7	"cell-specific higher layer signaling"
'931 patent	1-7	"start offset information"
'931 patent	1, 3, 5, 7	"repeated transmission is performed using the same uplink control channel resource in each uplink subframe in which the uplink control channel is repeatedly transmitted"
'931 patent	1, 3, 5, 7	"downlink control information"
'931 patent	1 and 5	"transmitting the response information on the downlink data"
'931 patent	1, 3, 5, 7	"information on a resource allocated to an uplink control channel"
'931 patent	1, 3, 5, 7	"terminal different from the MTC terminal"
'931 patent	5	"a controller configured to determine . . ."
'931 patent	1	"wherein the start offset information of the resource allocated to the uplink control channel is configured separated from start offset information for a terminal different from the MTC terminal"
'931 patent	3, 5, 7	"wherein the start offset information of the resource allocated to the uplink control channel is configured separated from offset information on a terminal different from the MTC terminal"
'932 patent	1	"including the uplink RRC message into a first message"
'932 patent	1, 8	"the access unit and the central unit distinguish signaling radio bearers based on radio bearer identification information-included in the first message and the second message"
'932 patent	1, 8	"distinguish"
'932 patent	1, 2, 8, 9	"the access unit"
'932 patent	2, 9	"the central unit comprises a node configured to provide a PDCP function, for transmission of the user plane data"
'932 patent	8	"the transmitter transmits the downlink RRC message to the terminal"

Asserted Patent	Asserted Claim(s)	Indefinite Term(s) and/or Phrase(s)
'942 patent	1, 5, 9	"information related to time and frequency"
'942 patent	1, 5, 9	"newly defined RNTI other than at least a cell-RNTI (C-RNTI)
'942 patent	1, 5, 9	"UE-specific radio resource control (RRC) signaling"
'942 patent	1, 5, 9	"is received for the reception"
'942 patent	2	"wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the first UE are different from second radio resources allocated for a second UE."
'942 patent	10	"wherein at least one of a subcarrier spacing and a time-domain scheduling unit of first radio resources allocated for the UE are different from second radio resources allocated for another UE."
'460 patent	1, 5, 9	"frequency hopping configuration information for a UL control channel and a UL data channel"
'460 patent	1, 5, 9	"based on the BWP configuration information and the frequency hopping configuration information"
'460 patent	1, 5, 9	"a frequency hopping offset set composed of one or more frequency hopping offset values"
'460 patent	1	"receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set"
'460 patent	5	"transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE; and"
'460 patent	9	"a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set;"
'460 patent	3, 7, 11	"a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP"
'460 patent	4, 8, 12	"the number of frequency hopping offset values included in the frequency hopping offset set is

Asserted Patent	Asserted Claim(s)	Indefinite Term(s) and/or Phrase(s)
		determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less"
'118 patent	1, 10	"the addition of the secondary base station SRB is determined by the secondary base station"
'118 patent	7	"determining, by the secondary base station, to add a secondary base station signaling radio bearer (SRB) to the user equipment;"
'118 patent	1, 7, 10	"determined", "determining"
'118 patent	1, 7, 9, 10	"the user equipment"
'118 patent	7	"the secondary base station"
'118 patent	7	"the user equipment configures dual connectivity by using a master base station and the secondary base station"
'118 patent	3, 12	"the addition of the secondary base station SRB is configured when the master base station performs a secondary base station addition procedure"
'118 patent	9	"in case the user equipment is unable to comply with the radio resource configuration information included in the RRC message, the user equipment is configured to transmit a failure information message to the master base station"
'118 patent	2, 8, 11	"the master base station and the secondary base station are base stations using radio access technologies different from each other."
'000 patent	1, 4, 5, 8, 9, 12	"uplink (UL) control information"
'000 patent	1, 5, 9	"UL control channel resource set configuration information"
'000 patent	1, 5, 9	"wherein . . . the one of the UL control channel resource sets is performed based on a size of the UL control information"
'000 patent	1, 5, 9	"UE specific radio resource (RRC) signaling"
'000 patent	2, 6, 10	"wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the UE"
'000 patent	3, 4, 7, 8, 11, 12	"downlink (DL) control information…"
'000 patent	9	"a receiver configured to receive…"
'000 patent	9	"a controller configured to determine…."
'000 patent	9	"a transmitter configured to transmit…"
'463 patent	1	"determining one of UL control channel resource sets

Asserted Patent	Asserted Claim(s)	Indefinite Term(s) and/or Phrase(s)
		contained in the UL control channel resource set configuration information"
'463 patent	1	"determining one of UL control channel resources contained in the determined UL control channel resource set"
'463 patent	1	"transmitting UL control information through the determined UL control channel resource"
'463 patent	1, 2, 3, 4, 5, 6, 7, 8, 9	"uplink (UL) control information"
'463 patent	1, 4, 7	"UL control channel resource set configuration information"
'463 patent	1, 5, 7, 8	"determined" / "determining" / "determine"
'463 patent	2, 5, 8	"wherein . . . the one of the UL control channel resource sets is performed based on a size of the UL control information"
'463 patent	1, 3, 4, 6, 7, 9	"downlink (DL) control information"
'463 patent	7	"a receiver configured to receive…"
'463 patent	7	"a controller configured to determine…"
'463 patent	7	"a controller configured to determine … one of UL control channel resources configuring the determined one UL control channel resource set"
'463 patent	7	a transmitter configured to transmit
'272 patent	1, 8, 15	"a number of OFDM symbols"
'272 patent	1, 8, 15	"bit string"
'272 patent	1, 8, 15	"one or more allocations of a time-domain resource"
'272 patent	1, 8, 15	"the allocation table includes information on a starting OFDM symbol and the number of the OFDM symbols which is smaller than or equal to the number of OFDM symbols included in the slot"
'272 patent	7, 14	"the number of OFDM symbols"
'272 patent	3, 10, 17	"further includes information on one or more allocations of a frequency-domain resource"
'272 patent	4, 11, 18	"supports a new radio access technology"
	4, 11, 18	"a new radio access technology"
'272 patent	5, 12, 19	"supports different numerologies which are defined by a subcarrier spacing (SCS)"
	5, 12, 19	"different numerologies"
'644 patent	1, 2, 3	"repeatedly allocated in a plurality of subframes"
'644 patent	1, 2, 3	"configuration information"

Asserted Patent	Asserted Claim(s)	Indefinite Term(s) and/or Phrase(s)
'644 patent	1, 2, 3	"higher layer signaling"
'644 patent	1, 2	"configuration information relating to the plurality of subframes"
'644 patent	1, 2, 3	"higher layer signaling"
'644 patent	1, 2, 3	"downlink control channels"
'644 patent	1, 3	"combining[/to combine] the received downlink control channels on the basis of[/based on] the configuration information"
'644 patent	1, 2, 3	"downlink control information"
'644 patent	1, 3	"combined downlink control channels"
'644 patent	1, 2, 3	"information on a start subframe of the plurality of subframes"
'644 patent	1, 2, 3	"information on the number of the plurality of subframes"
'644 patent	1	"receiving configuration information … through higher layer signaling"
'644 patent	2	"transmitting configuration information … through higher layer signaling"
'644 patent	3	"a receiver configured to receive configuration information … through higher layer signaling"
'161 patent	1, 3, 5	"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"
'161 patent	1, 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"
'161 patent	1, 3, 5	"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"
'161 patent	1, 3, 5	"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,"""
'161 patent	1, 3, 5	"the another code rate value of the another of the four CQI index values for 256QAM modulation is

<table>
<tr><th>Asserted Patent</th><th>Asserted Claim(s)</th><th>Indefinite Term(s) and/or Phrase(s)</th></tr>
<tr><td></td><td></td><td>calculated to be 948 using “code rate×1024,”“</td></tr>
<tr><td>’161 patent</td><td>1, 3, 5</td><td>“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. ““</td></tr>
<tr><td>’161 patent</td><td>2, 4, 6</td><td>“to have same difference within a predetermined error rate”</td></tr>
<tr><td>’161 patent</td><td>2</td><td>“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
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
<table><tr><th>CQI index</th><th>modulation</th><th>code rate × 1024</th><th>efficiency</th></tr><tr><td>0</td><td></td><td>out of range</td><td></td></tr><tr><td>1</td><td>QPSK</td><td>78</td><td>0.1523</td></tr><tr><td>2</td><td>QPSK</td><td>193</td><td>0.3770</td></tr><tr><td>3</td><td>QPSK</td><td>449</td><td>0.8770</td></tr><tr><td>4</td><td>16QAM</td><td>378</td><td>1.4766</td></tr><tr><td>5</td><td>16QAM</td><td>490</td><td>1.9141</td></tr><tr><td>6</td><td>16QAM</td><td>616</td><td>2.4063</td></tr><tr><td>7</td><td>64QAM</td><td>466</td><td>2.7305</td></tr><tr><td>8</td><td>64QAM</td><td>567</td><td>3.3223</td></tr><tr><td>9</td><td>64QAM</td><td>666</td><td>3.9023</td></tr><tr><td>10</td><td>64QAM</td><td>772</td><td>4.5234</td></tr><tr><td>11</td><td>64QAM</td><td>873</td><td>5.1152.</td></tr></table>”</td></tr>
<tr><td>’161 patent</td><td>4</td><td>“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
4. The method of claim 2, 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
<table><tr><th>CQI index</th><th>modulation</th><th>code rate × 1024</th><th>efficiency</th></tr><tr><td>0</td><td></td><td>out of range</td><td></td></tr><tr><td>1</td><td>QPSK</td><td>78</td><td>0.1523</td></tr><tr><td>2</td><td>QPSK</td><td>193</td><td>0.3770</td></tr><tr><td>3</td><td>QPSK</td><td>449</td><td>0.8770</td></tr><tr><td>4</td><td>16QAM</td><td>378</td><td>1.4766</td></tr><tr><td>5</td><td>16QAM</td><td>490</td><td>1.9141</td></tr><tr><td>6</td><td>16QAM</td><td>616</td><td>2.4063</td></tr><tr><td>7</td><td>64QAM</td><td>466</td><td>2.7305</td></tr><tr><td>8</td><td>64QAM</td><td>567</td><td>3.3223</td></tr><tr><td>9</td><td>64QAM</td><td>666</td><td>3.9023</td></tr><tr><td>10</td><td>64QAM</td><td>772</td><td>4.5234</td></tr><tr><td>11</td><td>64QAM</td><td>873</td><td>5.1152.</td></tr></table>”</td></tr>
<tr><td>’161 patent</td><td>6</td><td>“wherein and five CQI index values for 64QAM</td></tr>
</table>

<table>
<tr><th>Asserted Patent</th><th>Asserted Claim(s)</th><th>Indefinite Term(s) and/or Phrase(s)</th></tr>
<tr><td></td><td></td><td>modulation”</td></tr>
<tr><td>’161 patent</td><td>6</td><td>“to have a same difference”</td></tr>
<tr><td>’161 patent</td><td>6</td><td>“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
<table>
<tr><th>CQI index</th><th>modulation</th><th>code rate × 1024</th><th>efficiency</th></tr>
<tr><td>0</td><td></td><td>out of range</td><td></td></tr>
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<tr><td>11</td><td>64QAM</td><td>873</td><td>5.1152.</td></tr>
</table>
”</td></tr>
</table>

III. ACCOMPANYING DOCUMENT PRODUCTION

Pursuant to P.R. 3-4(a), Defendants are producing documentation sufficient to show the operation of any aspects or elements of each Accused Instrumentality identified by Pegasus in its P.R. 3-1(c) charts. Additionally, pursuant to P.R. 3-4(b), Defendants are producing herewith a copy of each prior art reference identified above pursuant to P.R. 3-3(a) which does not appear in the file histories of the Asserted Patents, as well as additional prior art references. To the extent any such prior art reference is not in English, Defendants has produced to Plaintiff or will produce to Plaintiff an English translation of the portion(s) of the non-English prior art reference(s) relied upon by Defendants.

DATED: December 23, 2024

Respectfully submitted,

Alston & Bird LLP

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Certificate of Service

I hereby certify that on December 23, 2024, the foregoing document was served by electronic mail on all counsel of record.

/s/ *Ross Barton*
Ross Barton

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