

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.,
Petitioners

v.

PANTECH CORP.,
Patent Owner

U.S. Patent No. 9,769,776
Filed: October 31, 2016
Issued: September 19, 2017
Inventor: Ki Bum Kwon, et al.

TITLE: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING
IN MULTIPLE COMPONENT CARRIER SYSTEM

Inter Partes Review No. 2025-00720

**DECLARATION OF APOSTOLOS K. KAKAES PH.D. IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,769,776**

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I, Apostolos K. Kakaes, Ph.D., declare as follows:

I. INTRODUCTION

1. I have been retained by OnePlus Technology (Shenzhen) Co., Ltd. (“OnePlus” or “Petitioner”) as a technical expert in connection with a petition for *inter partes* review (“IPR”) of U.S. Patent No. 9,769,776 (“the ’776 patent,” EX1001). I understand that the ’776 patent is assigned to Pantech Corp. (“Pantech” or “Patent Owner”).

2. I am being compensated for my time in this matter at an hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this matter. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this matter. I have no personal or financial stake or interest in the outcome of the present proceeding.

3. I have been asked, by counsel for Petitioner, to provide opinions based on my experience with and expertise in wireless communication technologies. In particular, I have been asked to offer opinions regarding the patentability of claims 1–8 of the ’776 patent (the “Challenged Claims”) in view of certain prior art references and the knowledge of a person of ordinary skill in the art (“POSITA”).

4. I have been asked by Petitioner to provide my opinion whether the Challenged Claims of the '776 patent were anticipated and/or would have been obvious to a POSITA at the time of the earliest priority date of the '776 patent. In performing my analysis, I have been asked to assume that the earliest priority date of the Challenged Claims of the '776 patent is the earliest claimed priority date, namely March 23, 2012.

5. Throughout this Declaration, I refer to specific passages, figures, and/or other portions of various exhibits. These citations are illustrative and are not intended to suggest that they are the only support for the proposition for which they are cited.

II. QUALIFICATIONS AND PROFESSIONAL BACKGROUND

6. My qualifications and professional experience are described in my curriculum vitae, a copy of which is provided herewith as Appendix A. The following is a brief summary of my relevant qualifications and professional experience.

7. I have personal knowledge and expertise concerning the relevant technologies based upon my education, training, or experience. My relevant experience includes a deep understanding of the systems that we broadly refer to as “1G,” “2G,” “3G,” “4G,” “LTE,” and “5G” communications systems, as well as other wireless communication technologies, including those based on the IEEE

802.11 set of standards (often referred to as WiFi), those related to IEEE 802.16 set of standards (often referred to as WiMAX).

8. I am an expert in the field of communication engineering and specifically, among others, the field of wireless communications. I have over 40 years of experience in electrical engineering and computer science and in fixed and mobile communications networks. I attended the University of Colorado from 1974 to 1980, during which I earned a Bachelor of Science (B.S.) and a Master of Science (M.S.) in applied mathematics with a minor in electrical engineering. I attended the Polytechnic Institute of New York between 1982 and 1988, during which I earned a Doctor of Philosophy (Ph.D.) in electrical engineering, with a minor in applied mathematics. My Ph.D. thesis was titled “Topological Properties and Design of Multihop Packet Radio Networks.” While pursuing my Ph.D. degree, I held a joint appointment as Special Research Fellow and Adjunct Instructor at the Polytechnic Institute of New York between 1985 and 1986 teaching graduate-level courses in Electrical Engineering.

9. Between 1982 and 1987, I worked at AT&T Bell Laboratories in Holmdel, New Jersey. While at AT&T Bell Laboratories, I worked on modeling, analysis, design, and performance evaluation of voice and data networks. I developed algorithms for DNHR (Dynamic, Non-Hierarchical Routing) used in the telephone network. I also analyzed advanced data services and formulation of

long-term plans for development of enhanced data services and network design tools to support such services.

10. I was an Assistant Professor of Electrical Engineering and Computer Science at The George Washington University (GWU) in Washington, D.C., between 1987 and 1994. During my association with GWU, I taught graduate courses in the area of communication engineering, including communication theory, coding theory, voice and data networking, and mobile communications. In the early 1990s I developed and taught the first course on Mobile Communications at GWU to Electrical Engineering graduate students. I also received several research awards/grants, including the prestigious NSF Research Initiation Award.

11. In 1988, I founded Cosmos Communications Consulting Corporation (“Cosmos”), which is a private communications engineering consulting firm specializing in mobile communications, and I have been the President of the company since its founding. Since 1994, I have worked full-time at Cosmos. At Cosmos, among various activities, I have consulted on high level technology-related issues and trends to corporate entities, governmental agencies, and international organizations, such as the United Nations.

12. I have provided technical consultancy to engineering firms, operators, and equipment vendors on issues related to existing or evolving technologies for mobile communications, and to the investment community on issues related to

both fixed and wireless communications technologies. I developed and taught hundreds of courses to thousands of engineers around the world in the area of communication engineering, mostly in the area of mobile, wireless communications.

13. Over the course of my career, I have authored and co-authored some thirty (30) publications on various aspects of fixed and mobile communications, as noted in my curriculum vitae. I am a life member of the Institute of Electrical and Electronics Engineers (IEEE) and have been actively involved in the Communications Society and the Information Theory Society of the IEEE. Between 1991 and 1992, I served as the Secretary of IEEE Communications Society National Capital Area Chapter. Between 1992 and 1993, I was the Vice-Chair of IEEE Communications Society National Capital Area Chapter. I was the Vice-Chair of the Communication Theory Technical Committee of the Communications Society of the IEEE for the 1993–1996 term, and Treasurer of the Communication Theory Technical Committee of the Communications Society of the IEEE for the 1996–1999 term.

14. I have served as a reviewer for the IEEE, book editors, other technical publications, and various National Science Foundation (NSF) Panels. I have organized technical sessions in technical conferences, including the IEEE International Conference on Communications (ICC) and IEEE Global

Communications Conference (Globecom). I served as the Technical Program Chair for the Communication Theory Mini-Conference in 1992.

15. During the past 35+ years, I have been lucky enough to be part of the community of engineers that have contributed to the astounding growth of the mobile communications industry. It started from a niche industry that was thought of as being something for the “rich and the famous” to becoming one of the most widespread household concepts, providing useful tools to all segments of the global society.

16. My involvement in this industry has included providing consulting services to company executives who needed to make deployment plans, taking into consideration the strengths and weaknesses of the technology, economics, user value, etc. As such, I have developed a deep understanding of all aspects of a given technology, its features, added value, and the like. In addition, my consulting services has included developing courses for the companies that were at the forefront of this developing technology. By definition, this previously non-existent technology was not taught in university courses, as it was too new. Having developed hundreds of courses over the years and taught thousands of engineers (and non-engineers alike), I have a solid understanding and knowledge of the technical developments and how their importance fits in the larger puzzle of a fast-developing technology.

17. My consulting has included providing training to engineers in the field that were deploying the various networks. For example, I have developed courses and provided training and consulting to the engineers deploying some of the earliest GSM networks in Germany and France, to be followed by many countries in Europe and around the world, including the United States when it was decided that GSM would be used in the U.S. Successful deployments of the initial GSM systems were followed by deployments of GPRS and EDGE, which was then followed by deployments of 3G UMTS systems worldwide. Of course, the 3G systems were followed by the currently most widespread deployments of 4G systems, also referred to as LTE, worldwide and most recently deployments of 5G networks. Thus, as I explain above, my experience includes a deep understanding of the entirety of each system that we broadly refer to as “1G,” “2G,” “3G,” “4G,” “LTE,” and “5G.”

18. Similarly, I have developed courses and provided training and consulting to engineers deploying and/or enhancing wireless local area networks using one or more of the IEEE 802.11 set of standards (often referred to as WiFi) as well as networks using the IEEE 802.16 set of standards (often referred to as WiMax).

19. As an expert consultant, I have served on both civil and criminal legal cases, including several patent infringement cases both at the ITC and in district

courts, as well as in support of IPR petitions at the Patent Trial and Appeal Board (PTAB) of the United States Patent and Trademark Office. I have also participated as a technical expert consultant in the analysis of large patent portfolios for the purposes of due diligence, sales, and merger and acquisition activities for some of the largest companies in the mobile communications space. These projects span a multidimensional spectrum of technologies in both fixed and mobile communications as they have evolved over the past more than 30 years.

III. INFORMATION CONSIDERED

20. In forming my opinions, I read and considered the '776 patent and its prosecution history, the exhibits listed in the Exhibit List below, as well as the other materials referenced herein.

Exhibit	Description
1001	U.S. Patent No. 9,769,776 (“the ’776 Patent”)
1002	File History of the ’776 Patent
1004	Declaration of Friedhelm Rodermund
1005	3GPP Technical Specification 36.331 v10.4.0 (“TS36.331”), December 2011
1006	Publication “R2-120218 – TA Group Handling” (“Sharp”)
1007	Publication “R2-115812 – Signalling for TA Group Configuration” (“Potevio”)
1008	Participant List from RAN2, Meeting #76, San_Francisco

Exhibit	Description
1009	U.S. Patent Application Publication No. US2013/0188613 to Dinan, et al. (“Dinan”)
1010	File History of U.S. Provisional Patent App. No. 61/590,366
1011	WIPO Publication No. WO2011/084005 A2 to Park, et al. (“Park”)
1012	Certified English-Language Translation of Park
1013	RESERVED
1014	“The GSM System for Mobile Communications” by Michel Mouly and Marie-Bernadette Pautet, 1992 (“Mouly”)
1015	“LTE-The UMTS Long Term Evolution” Second Edition, 2011 by Stefania Sesia, Issam Toufik, Matthew Baker (“Sesia”)
1016	3GPP Technical Specification 36.300 V8.9.0, June 2009
1017	3GPP Technical Specification 36.331 v.8.7.0, September 2009
1018	Participant List from RAN2, Meeting #77, Dresden, Germany
1019	RESERVED
1020	<i>Pantech Corp. v. Oneplus Tech. (Shenzhen) Co., Ltd.</i> , 5:24-cv-00038-RWS-JBB (E.D. Tex.), Plaintiff’s Infringement Contentions, November 27, 2024 (excerpts)
1021	Publication “R2-106856 – Introduction of Carrier Aggregation and UL/DL MIMO” (“Samsung”)

21. The opinions contained in this Declaration are based on the information I considered and my knowledge and professional judgment, guided by my understanding of how a POSITA would have understood the claims of the ’776

patent at the time of the earliest claimed priority date. I have also relied on my education, experience, research, training, and knowledge in the relevant art, and my understanding of any applicable legal principles described in this Declaration.

22. I reserve the right to supplement and amend any of my opinions in this Declaration based on documents, testimony, and other information that becomes available to me after the date of this Declaration.

IV. LEGAL STANDARDS

23. I am not a lawyer. For purposes of this Declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions. My understanding of the legal standards to apply in reaching the conclusions in this Declaration is also based on my experience applying similar standards in other patent-related matters, and my consideration of the materials submitted in this proceeding.

24. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can “anticipate” a claim. Second, I have been informed that the prior art can render a claim “obvious” to a person of ordinary skill in the art.

25. I have been informed that a dependent claim is a patent claim that refers back to another claim of the same patent. I have been informed that a

dependent claim includes all of the limitations of the claim or claims to which it refers.

26. I have been asked to provide my opinions as to whether the prior art anticipates or renders obvious claims 1–8 of the '776 patent from the perspective of a POSITA at the '776 patent's earliest claimed priority date of March 23, 2012.

27. I have been informed that in this IPR proceeding, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means “more likely than not.”

A. Level of Ordinary Skill in the Art

28. It is my understanding that the claims and specification of a patent are to be read and construed through the eyes of a hypothetical person of ordinary skill in the art (i.e. “POSITA”) at the time the alleged invention was made. To determine the appropriate level of one of ordinary skill in the art, I have been informed that the following factors may be considered: (a) the types of problems encountered by those working in the field and prior art solutions thereto; (b) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; and (c) the educational level of active workers in the field.

29. I have been instructed to assume a POSITA is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

B. Claim Construction

30. I have also been informed that, in order to assess whether the prior art satisfies a certain claim element in an invalidity analysis, the claim element must first be construed, and then the prior art must be evaluated to determine whether it satisfies the properly-construed element of the claim. I have been informed that a patent claim is to be construed from the perspective of a POSITA at the time the alleged invention was made, taking into account the claim language, the teachings of the patent specification, and the prosecution history.

31. I have been informed that the claims in the '776 patent should generally be understood in accordance with their plain and ordinary meaning, in the context of the '776 patent, to a POSITA at the time the invention was made. Unless otherwise specifically noted, my opinions in this Declaration are consistent with that plain and ordinary meaning.

C. Prior Art

32. I have been advised and understand the information used to evaluate whether an invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes patents and printed publications

that existed before the earliest priority date of the patent or the earliest invention date of the patent that can be established. I have been informed and understand that a patent or published patent application is prior art if its effective filing date is before the earliest priority date of the patent, or the earliest invention date of the claimed invention that can be established, and that a printed publication is prior art if it was publicly available before the earliest priority date of the patent or the earliest invention date that can be established. I am not aware of any evidence that would establish an invention date for any of the Challenged Claims that is earlier than the earliest claimed priority date, i.e., March 23, 2012. My opinions in this Declaration take the viewpoint of a POSITA in the timeframe immediately prior to the earliest claimed priority date of the Challenged Claims of the '776 patent, i.e. March 23, 2012.¹

D. Anticipation

33. I have been informed that a patent claim is invalid under 35 U.S.C. § 102 as being anticipated if each limitation of the claim is disclosed expressly or inherently in a single prior art reference. I further understand that a limitation is disclosed inherently if it is necessarily present in the prior art reference or is the natural result flowing from the disclosure of the prior art reference.

¹ See *infra* Section VI.B.

E. Obviousness

34. I have been informed that a patent claim is invalid under 35 U.S.C § 103 as being obvious if the differences between the claimed subject matter and the prior art are such that the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the alleged invention was made. I also understand that, in order to assess whether a claim would have been obvious in light of the prior art, I must step back in time and take the viewpoint of a POSITA at the time the alleged invention was unknown and just before it was made. I must then make a determination whether the claimed invention “as a whole” would have been obvious at that time to a POSITA.

35. I have been informed that the following facts are considered in determining whether a claimed invention is invalid as obvious over the prior art: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art and (4) any “secondary considerations” that may serve as evidence of nonobviousness, such as commercial success, long felt but unsolved needs, and failure of others.

36. I have been informed that, in an obviousness analysis, prior art must be analogous prior art to the patent being considered. I have been informed that a prior art reference is considered to be analogous if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the

challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

37. I have been informed that whether a prior art reference renders a patent claim obvious is determined from the perspective of a POSITA. I have been informed that a POSITA is presumed to know all relevant prior art, which are those that are in the same field of endeavor or are reasonably pertinent to the problem faced by the inventor. I have been informed that a reference may be modified or combined with other references or with a POSITA's own knowledge if a POSITA would have found the modification or combination obvious. In considering whether a claim is obvious, I can take account of inferences and creative steps that a POSITA would have employed, and the common knowledge of the art that a POSITA would have possessed.

38. I have been told that there is no rigid rule that a reference or combination of references must contain a "teaching, suggestion, or motivation" to combine references. However, I have also been informed that the "teaching, suggestion, or motivation" test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been informed that this test poses the question as to whether there is an express or implied teaching, suggestion or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

39. I have also been informed that the combination of familiar elements disclosed in the prior art according to known methods is likely to be obvious when it does no more than yield predictable results. I understand that if a technique has been used to improve one product and a POSITA would recognize that it would improve similar products in the same way, the use of that technique is obvious—unless its actual application is beyond the skill of a POSITA. I have been informed that the proper obviousness analysis considers whether a POSITA would have a “reasonable expectation of success” in achieving the claimed invention by modifying and/or combining prior art references.

40. I have been informed that obviousness does not require that the prior art contain an express suggestion to combine known elements to achieve the claimed invention. A reason to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually, as filtered through the knowledge of a POSITA. A reason for combining the elements in the manner claimed may also come from any need or problem known in the field.

41. I have been informed that, when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have been informed that if a POSITA had the ability to implement a predictable variation and would have seen the benefit of doing so, that variation is likely to have been obvious. I have been informed that in many fields,

there may be little discussion of obvious combinations in the scientific literature and market demand may drive design trends. I have been informed that, when there is a design need or market pressure and a finite number of predictable solutions, it would be obvious to a POSITA to pursue those known options.

42. I am not aware of any evidence of secondary considerations that would support a determination of non-obviousness of the Challenged Claims of the '776 patent.

F. Priority and Written Description

43. I understand that a patent application may rely on the filing date of an earlier-filed application on a claim-by-claim basis if the claim in question has written description support in the earlier-filed application. I also understand that, in order to satisfy the written description requirement, the specification must reasonably convey to a POSITA that the inventor had possession of the claimed subject matter.

V. FIELD OF TECHNOLOGY AND STATE OF THE ART

44. For this Declaration, I have assumed that the priority date of the challenged claims is March 23, 2012, as this is the earliest possible priority date. *See infra* Section VI.B. Thus, for purposes of this analysis, I assume that the time of the purported invention of the '776 patent was March 23, 2012, and have provided an overview of the background of the relevant technology at that time.

A. Field of Technology

45. As is explained in the BACKGROUND section of the '776 patent, the relevant field of technology is wireless communication in general and uplink synchronization in multiple component carrier systems in particular. EX1001, 1:19–23. “A multiple component carrier system means a wireless communication system capable of a carrier aggregation.” *Id.* at 1:36–37. Carrier aggregation, in turn, is “technology in which small fragmented [frequency] bands are efficiently used, and the carrier aggregation creates an effect that uses a logically wide band by aggregating a plurality of physically continuous or discontinuous bands in a frequency domain.” *Id.* at 1:37–42. The '776 patent states that the concept of a “Timing Advance Group (TAG)” —which is “a group of one or more serving cells having the same timing advance value” —was known to have been used in a multiple component carrier system “to effectively perform timing alignment.” *Id.* at 1:54–58.

46. The '776 patent describes the state of the art at the time of the alleged invention as including the continued development of communication protocols undertaken by the 3rd Generation Partnership Project (3GPP). *See, e.g.*, EX1001, 1:33–35 (“As multiple component carrier systems are recently introduced....”). In the same BACKGROUND section, the '776 patent states that “a signaling protocol for informing that a secondary serving cell is included in what TAG [Timing

Advance Group] has not yet been clearly defined.” *See* EX1001 (’776 patent) at 1:66–2:1. A POSITA would have understood at the time of the ’776 patent that the passive voice of the phrase “has not yet been clearly defined” refers to the ongoing work of the 3GPP, as is made clear from the ’776 patent’s usage of terms used by 3GPP, such as “eNB”, “PDCCH”, “RA-RNTI”, “C-RNTI”, etc. Thus, a proper determination of the State of the Art includes a review of the structure, procedures and work-product of the 3GPP, which I present in Section V.B below.

47. In the interest of clarity and completeness, I will review the development of wireless communications since the early days and the working procedures and work product of the 3GPP.

B. Third Generation Partnership Project (3GPP)

48. “Wireless communications” necessarily implies that information is transmitted without the use of “wires.” This is accomplished by transmitting electromagnetic waves from some point of origin A with the intent that the radio waves will be successfully received at some intended destination point B.

49. The “Advanced Mobile Phone System” (AMPS) was the first nationwide wireless communications system standardized in the USA. AMPS is referred to as a first generation or “1G” cellular communication technology. A subsequent short-lived system referred to as IS-54 developed only to be quickly replaced by a better system referred to as IS-136. IS-54 and IS-136 are now

commonly referred to as second generation or “2G” technologies. Around the same time, Qualcomm began developing a different system to replace AMPS in direct competition with IS-54/IS-136. This new system was standardized in what is called the “IS-95 standard,” or simply just “IS-95.” IS-95 was the first ever code division multiple access (CDMA) based digital cellular technology. CDMA allows multiple access to the digital radio for transmission of voice, data, and signaling data. IS-95 was first published in 1995 and adopted as a wireless communications standard in the USA by the Telecommunications Industry Association.

50. Around this same time period as the IS-95 was being developed in the USA, the European Telecommunications Standard Institute (ETSI) developed the Global System for Mobile Communications (GSM) technical specifications. Unlike IS-95, GSM is based on a time division multiple access (TDMA) technology. Similar to IS-54 and IS-136, IS-95 and GSM are also commonly referred to as “2G” technologies as they were the first viable cellular systems to use digital transmission techniques, as opposed to the analog techniques used in AMPS.

51. GSM continued to evolve with the development of GPRS (General Packet Radio Service) and of EDGE (Enhanced Data rates for GSM Evolution). GPRS and/or EDGE have sometimes been referred to as “2.5G” even though there is no general agreement as to what exactly “2.5G” does or does not include. In any

case, GSM came to enjoy greater market share globally than its IS-95 CDMA-based competitor. In the late 1990s, IS-95 had proven that an air interface based on CDMA was viable. Additionally, GSM had developed the necessary networking protocols that were second to none. In a somewhat unusual, but entirely rational and thus not unexpected way, the world converged in “marrying” the best aspects of the TDMA GSM system with the best aspects of the CDMA IS-95 system to create an improved worldwide system. As part of that effort, a new organization was formed called the “3rd Generation Partnership Project,” or “3GPP.” The 3GPP was tasked with developing this new wireless communication specifications, which was referred to as a “3rd Generation” or “3G” specification.

52. The 3GPP is a joint undertaking by national and regional telecommunication standards organizations and member companies worldwide focused on defining interoperable telecommunications networks and user equipment. 3GPP was formed in 1998 with an initial objective of producing technical specifications for a third generation (“3G”) cellular communication system called the Universal Mobile Telecommunications Service (UMTS). UMTS is a 3G mobile cellular system for networks based on the second generation (2G) Global System for Mobile Communications (GSM) standard in conjunction with the best aspects of the IS-95 air interface as I mentioned above.

53. While 3GPP is not formally a standards-setting organization, it operates as one from a practical perspective. 3GPP develops technical specifications that are then typically adopted by the respective standards-setting bodies of a given country or region. At the core of 3GPP's organization lies seven "Organizational Partners," each of which is a standards-setting organization in a different country or region:

- The Association of Radio Industries and Businesses, or ARIB (Japan);
- Telecommunication Technology Committee, or TTC (Japan);
- The Alliance for Telecommunications Industry Solutions, or ATIS (USA);
- China Communications Standards Association, or CCSA (China);
- The European Telecommunications Standards Institute, or ETSI (Europe);
- Telecommunications Standards Development Society, or TSDSI (India); and
- Telecommunications Technology Association, or TTA (Korea).

See, e.g., "About 3GPP" (<https://www.3gpp.org/about-us/partners>).

54. 3GPP employs a model similar to one that had been used earlier by the European Telecommunications Standards Institute (ETSI), which had developed GSM. There is a 3GPP hierarchical structure in which Working Groups (WGs) are the source of technical contributions, some of which ultimately mature into Technical Specifications. In addition, several WGs are part of a given Technical Specification Group, or TSG. There are several Technical Specification

Groups (TSGs), each one of them having a number of WGs and covering technical subject matter that is defined and follows a logical, hierarchical structure. As in the 2012 time period, the current three active 3GPP TSGs are the Radio Access Network (RAN), Service and System Aspects (SA), and Core Network and Terminals (CT) TSGs. The RAN TSG is the TSG responsible for the standards relevant to '776 patent.

55. The RAN TSG, in turn, consists of several Working Groups, referred to, for example, as RAN1 and RAN2 or RAN WG1 and RAN WG2. Each WG holds period meetings in which technical documents (or TDoc for short) are presented and discussed for possible inclusion in the Technical Specifications (TS), sometimes also referred to as Technical Standards. These meetings are numbered and referred to as, for example, TSG-RAN WG2 Meeting #50, which refers to Meeting #50 of Working Group 2 of the RAN TSG. Different proposals are discussed, their pros and cons considered and ultimately some of them, or some hybrid of one or more of them, end up being approved and included in the TS.

56. In the late 1990s, 3GPP successfully developed UMTS, which enjoyed worldwide success. A few years later, around 2004, 3GPP initiated the Long Term Evolution (LTE) project. As mentioned above, the '776 patent specifically refers to LTE as developed by 3GPP. EX1001, 1:25–32.

57. The LTE project had several goals for a fourth-generation (4G) cellular standard, including increased data rates, improved quality of service, and decreased complexity. Over the next four years, 3GPP worked to lay the groundwork for and develop the LTE technical specifications, which were first released in December of 2008, in what was called “Release 8.”

58. The LTE-related specifications developed by 3GPP have been, and continue to be, developed with additions of new features and/or modifications (and in some cases elimination) of existing ones. As the “Foreword” section of TS36.331 explains in the context of TS36.331, the contents of a Technical Specification document, such as TS36.331, “are subject to continuing work within the TSG [Technical Specifications Group] and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

EX1005 at page 13.

59. A “Change History” is typically provided at the end of each Technical Specification which provides a summary of the changes that have taken place. As can be seen (See EX1005 at pages 288-296). As shown in the highlighted portion below, the first approved version of LTE is dated December 2007 and bears the version number 8.0.0, while the previous version was 1.0.0, i.e., was “presented to TSG for information,” since the first digit of the previous (i.e., “Old”) version is a “1.”

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
12/2007	RP-38	RP-070920	-	-	Approved at TSG-RAN #38 and placed under Change Control	1.0.0	8.0.0
03/2008	RP-39	RP-080163	0001	4	CR to 36.331 with Miscellaneous corrections	8.0.0	8.1.0
03/2008	RP-39	RP-080164	0002	2	CR to 36.331 to convert RRC to agreed ASN.1 format	8.0.0	8.1.0
05/2008	RP-40	RP-080361	0003	1	CR to 36.331 on Miscellaneous clarifications/ corrections	8.1.0	8.2.0
09/2008	RP-41	RP-080693	0005	-	CR on Miscellaneous corrections and clarifications	8.2.0	8.3.0

60. Said “approved document under change control,” i.e., version 8.0.0, continued to be changed with numerous “changes of substance” incorporated in successive versions up to version 8.7.0, to be followed by a new “approved document under change control” released after v8.7.0, namely version 9.0.0 dated September 2009. Version 9 continued to also be improved as reflected in successive versions 9.1.0, 9.2.0, 9.3.0, 9.4.0, and 9.5.0. (EX1005 at pages 291-293)

61. Version 9.5.0 was followed by a new approved version under change control, i.e., v10.0.0, dated December 2010. As shown in the highlighted portion below, one of the added features, and relevant to the ’776 patent, was the

“Introduction of Carrier Aggregation and UL/DL MIMO.” EX1005 at page 293.

Version 10.0.0 continued to be improved as reflected in successive versions 10.1.0, 10.2.0, 10.3.0, 10.4.0 all of which predate the earliest claimed priority date of March 23, 2012.

12/2010	RP-50	RP-101197	0483	-	Clarification on Meaning of FGI Bits	9.4.0	9.5.0
	RP-50	RP-101197	0485	-	Clarification regarding reconfiguration of the quantityConfig	9.4.0	9.5.0
	RP-50	RP-101210	0486	1	Corrections to the presence of IE regarding DRX and CQI	9.4.0	9.5.0
	RP-50	RP-101210	0493	-	The field descriptions of MeasObjectEUTRA	9.4.0	9.5.0
	RP-50	RP-101197	0498	1	Clarification of FGI settings non ANR periodical measurement reporting	9.4.0	9.5.0
	RP-50	RP-101209	0500	-	Corrections to RLF Report	9.4.0	9.5.0
	RP-50	RP-101206	0519	1	T321 timer fix	9.4.0	9.5.0
	RP-50	RP-101197	0524	-	Restriction of AC barring parameter setting	9.4.0	9.5.0
	RP-50	RP-101210	0525	-	Removal of SEQUENCE OF SEQUENCE in UEInformationResponse	9.4.0	9.5.0
	RP-50	RP-101197	0526	1	Clarification regarding default configuration value N/A	9.4.0	9.5.0
	RP-50	RP-101431	0532	-	Splitting FGI bit 3	9.4.0	9.5.0
	RP-50	RP-101183	0476	4	36.331 CR on Introduction of Minimization of Drive Tests	9.4.0	10.0.0
	RP-50	RP-101293	0477	4	AC-Barring for Mobile Originating CSFB call	9.4.0	10.0.0
	RP-50	RP-101214	0478	-	Addition of UE-EUTRA-Capability descriptions	9.4.0	10.0.0
	RP-50	RP-101214	0481	-	Clarification on Default Configuration for CQI-ReportConfig	9.4.0	10.0.0
	RP-50	RP-101215	0487	-	CR to 36.331 adding e1xCSFB support for dual Rx/Tx UE	9.4.0	10.0.0
	RP-50	RP-101227	0488	1	Introduction of Carrier Aggregation and UL/ DL MIMO	9.4.0	10.0.0
	RP-50	RP-101228	0489	1	Introduction of relays in RRC	9.4.0	10.0.0
	RP-50	RP-101214	0490	1	Priority indication for CSFB with re-direction	9.4.0	10.0.0
	RP-50	RP-101214	0491	-	SIB Size Limitations	9.4.0	10.0.0
	RP-50	RP-101214	0513	-	Combined Quantity Report for IRAT measurement of UTRAN	9.4.0	10.0.0
	RP-50	RP-101214	0527	1	UE power saving and Local release	9.4.0	10.0.0
	RP-50	RP-101429	0530	1	Inclusion of new UE categories in Rel-10	9.4.0	10.0.0

62. I further note that release 10 continued being developed as can be seen on the screen shot below up to v10.22.0:

General			Versions			Responsibility			Related			Specification #: 36.331		
Meetings		Version	Upload date		Comment									
RAN#80		10.22.0	2018-07-08											
RAN#77		10.21.0	2017-09-25											
RAN#74		10.20.0	2016-12-30											
RAN#70		10.19.0	2016-01-04											
RAN#69		10.18.0	2015-09-25											
RAN#68		10.17.0	2015-07-08											
RAN#67		10.16.0	2015-03-23											
RAN#66		10.15.0	2015-01-05											
RAN#65		10.14.0	2014-09-23											
RAN#64		10.13.0	2014-07-03											
RAN#62		10.12.0	2014-01-07											
RAN#61		10.11.0	2013-09-19											
RAN#60		10.10.0	2013-07-04											
RAN#59		10.9.0	2013-03-22											
RAN#58		10.8.0	2013-01-07											
RAN#57		10.7.0	2012-09-26											
RAN#56		10.6.0	2012-07-03											
RAN#55		10.5.0	2012-03-14											
RAN#54		10.4.0	2011-12-22											

(See <https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2440>)

63. LTE continued and still continues to be improved with new releases, i.e., Rel 9, Rel 10, and so on. As of today, LTE is defined up to Release 18, with version 18.5.0 released in March 2025.

64. In parallel with the continued development of LTE, 3GPP developed the next generation system, referred to as “5G,” or “New Radio (NR).” The first Release of 5G is Rel 15 and occurred in 2018.

C. State of the Art

1. Timing Advance

65. In some communication systems, the time of arrival of a signal from a mobile device to a base station has to be tightly controlled. If the signal “spills over” past its allocated time, it will interfere with signals intended to arrive at such later time. Such “delayed arrival” of the signal can be caused by the round trip propagation delay² of a signal from a base station to a mobile, and back. This delay is referred to as “propagation delay” as it is indeed caused by the propagation of the radio waves to and from the mobile.

66. This potential problem, and a solution to it, has been known for a long time. For example it was known and used in the 2nd Generation GSM system discussed above. *See, for example*, “The GSM System for Mobile Communications” by Michel Mouly and Marie-Bernadette Pautet, 1992, at page

² While signals travel very fast by human standards, they are not instantaneous. Specifically, they travel at the speed of light which is 300,000 km/sec. Thus, a distance between a base station and a mobile of, for example, 6km, would result in a delayed arrival by 40 µsec, which is too high given the time constants of the relevant communication systems.

201: “When the mobile station is far from the BTS, [Base Transceiver Station]³ propagation delays cannot be neglected.... The only solution is that the mobile station advances its emission relatively to its reception by a time compensating the to and fro propagation delay. This value is called the **timing advance**.” (emphasis in the original). EX1014 at 201.

67. Such timing alignment was also necessary in the 4G/LTE system. And, again, the solution adopted prior to the earliest claimed priority date of the ’776 patent was to use timing advance in a manner similar to that used in GSM.

68. This is explained, for example, in “LTE-The UMTS Long Term Evolution” Second Edition, 2011 by Stefania Sesia, Issam Toufik, Matthew Baker, (“Sesia”) at page 408: “For LTE, uplink orthogonality is maintained by ensuring that the transmission from different UEs in a cell are time-aligned at the receiver of the eNodeB. This avoids intra-cell interference occurring, both between UEs assigned to transmit in consecutive subframes and between UEs transmitting on adjacent subcarriers. Time alignment of the uplink transmissions is achieved by applying a *timing advance* at the UE transmitter, relative to the received downlink timing. The main role of this is to counteract differing propagation delays between different UEs.... A similar approach is used in GSM.” EX1015 at 408 (emphasis in the original).

³ BTS is the acronym for a Base Station used in GSM.

2. Multiple Component Carrier System

69. As discussed in the Background section of the '776 patent, “[a] multiple component carrier system means a wireless communication system capable of a carrier aggregation.” EX1001, 1:37–38. Carrier aggregation, in turn, uses “small fragmented bands” to create “a logically wide band by aggregating a plurality of physically continuous or discontinuous bands in a frequency domain.” *Id.* at 1:37–42.

70. Indeed, carrier aggregation was introduced no later than November 2010 at Meeting #72 of the TSG RAN Working Group 2 as can be seen from the Samsung “CHANGE REQUEST” (“CR”) titled “Introduction of Carrier Aggregation and UL/DL MIMO.” EX1021, pg. 1. The stated “Reason for change” is “to capture the RAN2 agreements regarding Carrier Aggregation.” *Id.*

71. In the “Summary of change” section, Samsung discloses that “Connection control” would provide for “secondary cell addition, modification and release” while “PDUs/ Configuration parameters” would include “top level fields within the reconfiguration message to support addition/ modification and release of secondary cells, including a cell index.” *Id.*, pg. 2.

72. The same Samsung CR explains that for “SCells, change of system information is handled by release and addition of the concerned SCell, which may be done with a single *RRConnectionReconfiguration* message.” *Id.* at section

5.2.1.1, pg 6 (emphasis in the original). As I explain in Section X, a POSITA would know that the *RRCConnectionReconfiguration* is an RRC message, which this Samsung CR also clarifies.

73. The State of the Art regarding carrier aggregation is further discussed in this Samsung CR. For example, it explains that “E-UTRAN can independently add, remove or modify SCells by means of the RRC connection reconfiguration procedure using the *RRCConnectionReconfiguration* message, either including the *mobilityControlInfo* or not.” *Id.* at 5.3.1.3, pg. 9 (emphasis in original).

74. Consistent with the continued development of TS36.331, in Park’s Background section, they discuss that it was known to a POSITA that, whereas 3GPP LTE defined usage of a single carrier at a time, 3GPP LTE-A defined simultaneous usage of multiple carriers using carrier aggregation. EX1012, [2]–[3]. “The component carrier is defined with a center frequency and a bandwidth. The component carrier may correspond to one cell. A multiple carrier system uses a plurality of component carriers having a narrower bandwidth than a full bandwidth.” *Id.* at [3]. At the time of the earliest claimed priority date of the ’776 patent, a POSITA would have known that various protocols were needed to transition from LTE to LTE-A and certain ones were being selected from various known solutions for implementation into the 3GPP technical specifications.

75. For example, as Sesia explains, using a timing advance for more than one carrier was also known in the art. Specifically, at page 642, Sesia explains, “the timing of the PCell [Primary Serving Cell] and all SCells [Secondary Serving Cells]⁴ configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2 [which is discussed above in the previous paragraph]) is therefore sufficient to control the UE’s uplink transmission timing for all the uplink CCs [Component Carriers] together.” EX1015 at 642.

76. Sesia continues to explain that it is “expected that Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” *Id.*

77. In short, the concept of timing advance/time alignment (TA) and having (a) multiple serving cells that a UE can use and (b) different serving cells having different values for their respective TA was well known before March 23, 2012, the earliest claimed priority date of the ’776 patent.

3. Timing Advance Group (TAG)

78. As mentioned above, the ’776 patent recognized that the concept of a TAG (i.e., “a group of one or more serving cells having the same timing advance

⁴ Note that the abbreviations PCell and SCells are provided on page 624 where it is also explained that “From the higher-layer perspective each CC [Component Carrier] appears as a separate cell with its own Cell ID.” Thus it was understood that a specific Component Carrier is also referred to as a “Cell,” be it a Primary Serving Cell or a Secondary Serving Cell.

value”) was known prior to the earliest possible priority date of the ’776 patent and was recognized as having been used in a multiple component carrier system “to effectively perform timing alignment.” *Id.* at 1:54–58. The ’776 patent described the prior practice of a base station in a wireless communication system informing a User Equipment (UE) of the TAGs:

A base station can indicate that a secondary serving cell is included in what TAG for each secondary serving cell. For example, a base station can inform a terminal [i.e., a User Equipment (UE)] that a first secondary serving cell is included in a first TAG, a second secondary serving cell is included in a second TAG, and a third secondary serving cell is included in a first TAG, regarding the three secondary serving cells configured in the terminal.

EX1001, 1:58–65.

4. Protocol Stack

79. The concept of a “Protocol Stack” in data networks goes back to at least the 1980’s. However, a detailed historical review is not necessary. Suffice it to say that said concept has been adopted in mobile communications, including in 3G systems as well as early versions of the 4G/LTE system. Relevant to this case is the LTE specifications for which this is shown, for example, in the 3GPP TS 36.300 V8.9.0, dated June 2009 (EX1016), as shown below (*see* pages 18–19):

4.3 Radio Protocol architecture

In this subclause, the radio protocol architecture of E-UTRAN is given for the user plane and the control plane.

...
...

4.3.2 Control plane

The figure below shows the protocol stack for the control-plane, where:

- PDCP sublayer (terminated in eNB on the network side) performs the functions listed for the control plane in subclause 6, e.g. ciphering and integrity protection;
- RLC and MAC sublayers (terminated in eNB on the network side) perform the same functions as for the user plane;
- RRC (terminated in eNB on the network side) performs the functions listed in subclause 7, e.g.:
 - Broadcast;
 - Paging;
 - RRC connection management;
 - RB control;
 - Mobility functions;
 - UE measurement reporting and control.
- NAS control protocol (terminated in MME on the network side) performs among other things:
 - EPS bearer management;
 - Authentication;
 - ECM-IDLE mobility handling;
 - Paging origination in ECM-IDLE;
 - Security control.

NOTE: the NAS control protocol is not covered by the scope of this TS and is only mentioned for information.

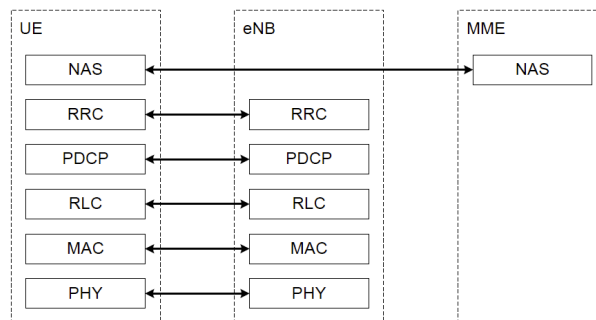


Figure 4.3.2-1: Control-plane protocol stack

EX1016 at 18–19

80. The above makes it clear that the RRC was known to be responsible for “perform[ing] the function,” inter alia, of “RRC connection management” as is shown in the portion of the specifications above. To be clear, the acronym RRC is

defined in the specifications in the list of acronyms on pages 12-15 as shown, in relevant part only, below (highlighted portion added):

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ACK	Acknowledgement
ACLR	Adjacent Channel Leakage Ratio
AM	Acknowledge Mode
AMBR	Aggregate Maximum Bit Rate
ANR	Automatic Neighbour Relation

....

....

RBG	Radio Bearer Group
RF	Radio Frequency
RIM	RAN Information Management
RLC	Radio Link Control
RNC	Radio Network Controller
RNL	Radio Network Layer
RNTI	Radio Network Temporary Identifier
ROHC	Robust Header Compression
RRC	Radio Resource Control
RRM	Radio Resource Management
RU	Resource Unit
S-GW	Serving Gateway
S1-MME	S1 for the control plane

EX1016 at 12–15

81. Furthermore, the RRC protocol was also defined in the early days of LTE, for example as shown in TS 36.331 V8.7.0, dated September 2009 (EX1017), titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) radio Resource Control (RRC); Protocol specification (Release 8).”

82. A relevant portion of the Table of Contents shows that the RRC defines a number of messages, for example the “*RRCConnectionReconfiguration*” message, as highlighted herein.

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-	<i>CellIdentity</i>	138
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–	<i>PhysCellIdGERAN</i>	144
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–	<i>MeasObjectId</i>	153
–	<i>MeasObjectToAddModList</i>	153
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–	<i>RAT-Type</i>	164
–	<i>RRC-TransactionIdentifier</i>	164
–	<i>S-TMSI</i>	164
–	<i>UE-CapabilityRAT-ContainerList</i>	164
–	<i>UE-EUTRA-Capability</i>	165
–	<i>UE-TimersAndConstants</i>	168

EX1017 at 6–8, 77–168

83. Continuing with the above mentioned message, a POSITA would know that it is defined on page 88-89, as shown below:

– *RRConnectionReconfiguration*

The *RRConnectionReconfiguration* message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: E-UTRAN to UE

***RRConnectionReconfiguration* message**

```
-- ASN1START
RRConnectionReconfiguration ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        c1                       CHOICE {
            rrcConnectionReconfiguration-r8      RRCConnectionReconfiguration-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture      SEQUENCE {}
    }
}
```

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```
}
}
RRConnectionReconfiguration-r8-IEs ::= SEQUENCE {
    measConfig          MeasConfig          OPTIONAL, -- Need ON
    mobilityControlInfo MobilityControlInfo  OPTIONAL, -- Cond HO
    dedicatedInfoNASList SEQUENCE (SIZE(1..maxDRB)) OF
        DedicatedInfoNAS OPTIONAL, -- Cond nonHO
    radioResourceConfigDedicated RadioResourceConfigDedicated OPTIONAL, -- Cond HO-toEUTRA
    securityConfigHO          SecurityConfigHO OPTIONAL, -- Cond HO
    nonCriticalExtension       SEQUENCE {}    OPTIONAL -- Need OP
}
SecurityConfigHO ::= SEQUENCE {
    handoverType CHOICE {
        intraLTE SEQUENCE {
            securityAlgorithmConfig SecurityAlgorithmConfig OPTIONAL, -- Need OP
            keyChangeIndicator      BOOLEAN,
            nextHopChainingCount    NextHopChainingCount
        },
        interRAT SEQUENCE {
            securityAlgorithmConfig SecurityAlgorithmConfig,
            nas-SecurityParamToEUTRA OCTET STRING (SIZE(6))
        }
    },
    ...
}
-- ASN1STOP
```

***RRConnectionReconfiguration* field descriptions**

<i>dedicatedInfoNASList</i>
This field is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for each PDU in the list.
<i>nas-securityParamToEUTRA</i>
This field is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for this field, although it affects activation of AS- security after inter-RAT handover to E-UTRA. The content is defined in TS 24.301.
<i>keyChangeIndicator</i>
'true' is used only in an intra-cell handover when a K_{ANB} key is derived from a native K_{ASME} key taken into use through the successful NAS SMC, as described in TS 33.401 [32] for K_{ANB} re-keying. 'false' is used in an intra-LTE handover when the new K_{ANB} key is obtained from the current K_{ANB} key or from the NH as described in TS 33.401 [32].
<i>nextHopChainingCount</i>
Parameter NCC: See TS 33.401 [32]

Conditional presence	Explanation
<i>HO</i>	The field is mandatory present in case of handover within E-UTRA or to E-UTRA; otherwise the field is not present.
<i>nonHO</i>	The field is not present in case of handover within E-UTRA or to E-UTRA; otherwise it is optional present, need ON.
<i>HO-toEUTRA</i>	The field is mandatory present in case of handover to E-UTRA; otherwise the field is optionally present, need ON.

EX1017 at 88–89

84. As shown above, a POSITA would have understood at the earliest possible priority date of the '776 patent that the “*RRCConnectionReconfiguration*” message, just as other RRC messages, can consist of one or more fields.

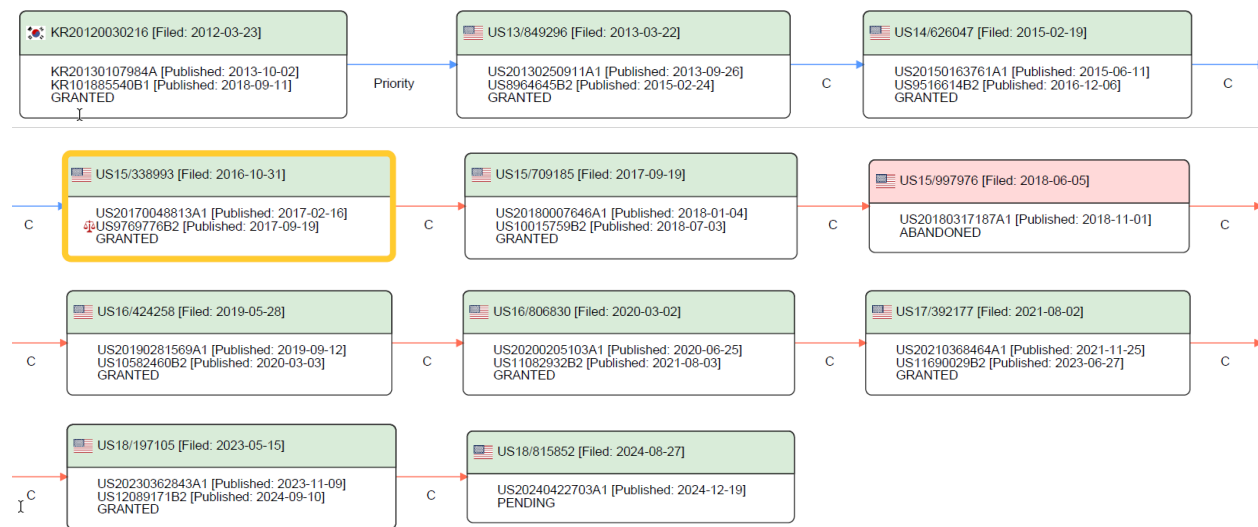
85. In short, it was well known prior to the earliest claimed priority date of the '776 patent that RRC messages were used for, among other purposes, modifying “an RRC connection,” as shown above. Furthermore, as recognized in the BACKGROUND section of the '776 patent, it was well known prior to the earliest claimed priority date of the '776 patent that a TAG “is configured in response to higher layer signaling.” EX1001, at 1:54–58. A POSITA would have understood that “higher layer signaling” is referencing the RRC layer and its messages.

86. It was furthermore known that a given RRC message includes one or more fields providing specific relevant information. The specific structure of any one of these messages is not important, but I will point out that a specific message can contain a number of Information Elements (IE) and each IE can, in turn, contain one or more IE. Ultimately, even though there can be one or more levels of “nesting” of IE, the message contains a field providing specific relevant information.

VI. THE '776 PATENT

A. Overview of the '776 Patent

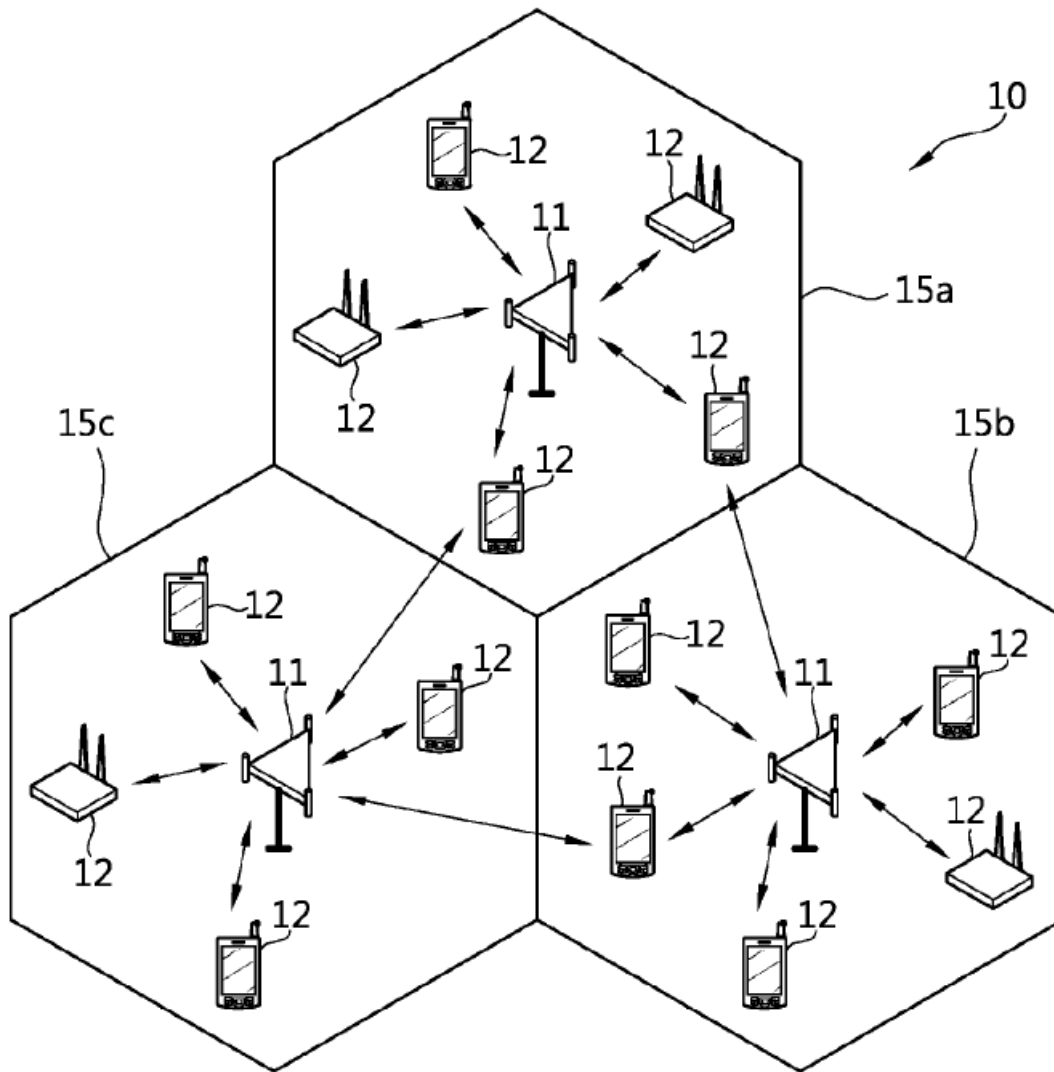
87. I understand that the '776 patent is one of eight issued U.S. patents, one abandoned U.S. patent application, and one pending U.S. patent application that claim priority to Korean patent application KR10-2012-0030216, which was filed on March 23, 2012.



88. The '776 patent relates generally to wireless communication and more particularly to “an apparatus and method for uplink synchronization in a multiple component carrier system.” EX1001 at 1:19–23. Specifically, the '776 patent describes an apparatus and method “for reorganizing a [Timing Advance Group (TAG)] based on [a Radio Resource Control] (RRC) connection reconfiguration procedure” or a random access procedure and an apparatus and method “for sending TAG configuration information for reorganizing a TAG and secondary serving cell configuration information.” *Id.* at 2:9–21.

89. According to the '776 patent, a user equipment (UE) includes: a receiving unit and a radio resource control (RRC) processing unit. The receiving unit receives, from a serving base station, secondary serving cell (SCell) configuration information which includes a first field and a second field. The first field includes an SCellIndex of an SCell to indicate a removal of the SCell, and the second field includes at least one of the SCellIndex to indicate an addition of the SCell and a TAG ID indicating a TAG of the SCell. The RRC processing unit: (1) performs the addition of the SCell after performing the removal of the SCell from one or more SCells configured in the UE, and (2) reorganizes the TAG by including the SCell in the TAG. EX1001, Abstract.

90. FIG. 1 of the '776 patent shows a wireless communication system 10 in which a UE 12 is used. EX1001, 2:59-60; FIG. 1. In FIG. 1, the wireless communication system 10 includes Base Stations (BS) 11 providing communication services to specific cells 15a, 15b, 15c classified into a plurality of areas (also called sectors). *Id.* at 4:1-10. A given UE 12 can be in communication with one or more of the BSs 11. *Id.* at FIG. 1.



EX1001, FIG. 1

91. In the BACKGROUND section, the '776 patent recognizes that it was known that “[i]n a multiple component carrier , in order to effectively perform timing alignment, a concept of a Timing Advance group (TAG) is used.” EX1001, 1:54–56. Furthermore, the BACKGROUND section indicates that it was known that the “TAG is a group of one or more serving cells having the same timing advance value and is configured in response to higher layer signaling. A base

station can indicate that a secondary serving cell is included in what TAG for each secondary serving cell.” *Id.* at 1:56–65.

92. The ’776 patent goes on to state that what has allegedly “not yet been clearly defined” is a “signaling protocol for informing that a secondary serving cell is included in what TAG.” EX1001 at 1:66–2:1. Furthermore, the patent states that “when a TAG to which a secondary serving cell belongs is changed according to a channel condition, whether a terminal will be informed using what method and how the method will be implemented” had “not yet been disclosed” prior to the ’776 patent’s priority date. *Id.* at 2:1–5.

93. Challenged claim 1 allegedly discloses apparatus to rectify this. In summary, the claimed UE includes “a receiver” to receive from a base station: a “first field” comprising a serving cell index (SCell) to indicate the release of a serving cell (SCell) and a “second field” comprising at least one other SCell index to indicate the addition of one or more serving cell(s) and “an identifier of a timing advance group (TAG)” associated with those one or more serving cells. *Id.* at 51–58. The UE of claim 1 also includes a “radio resource control (RRC) processor” that is called for to perform the actions called for by the information received by the receiver, i.e., to release the serving cell that was identified in the first field, to add the one or more serving cells identified in the second field, and to associate the one or more serving cells being added with another available serving cell with the

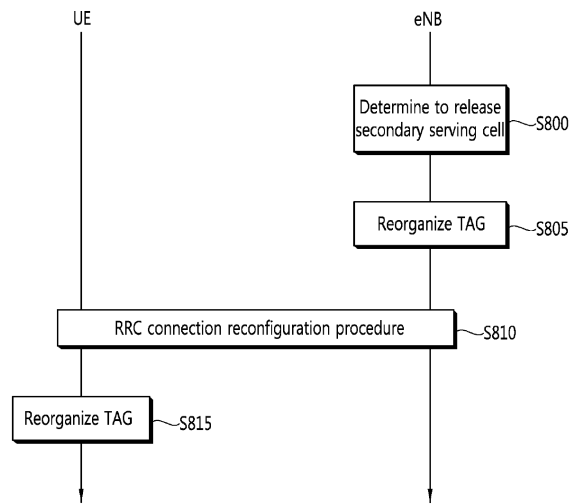
same TAG identifier corresponding to a TAG with SCells having the same timing advance (TA) value, *id.* at 33:59–34:3, reiterating the known fact that “the TAG is a group of one or more serving cells [(SCells)] having the same timing advance [(TA)] value.” *Id.* at 1:56–58..

94. Dependent claim 2 requires that “the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG.” EX1001 at 34:4–7. Dependent claim 3 requires that the fields of claim 1 are received “through a RRC connection reconfiguration message.” *Id.* at 34:8–10. Dependent claim 4 requires that the “first field” of claim 1 comprises “an indication to remove an SCell from SCells available to the UE.” *Id.* at 34:11–13. Claims 5–8 are method claims (“a method of user equipment (UE)”) that generally correspond to claims 1–4, respectively. *Cf. id.* at 33:51–34:13 with *id.* at 34:14–41.

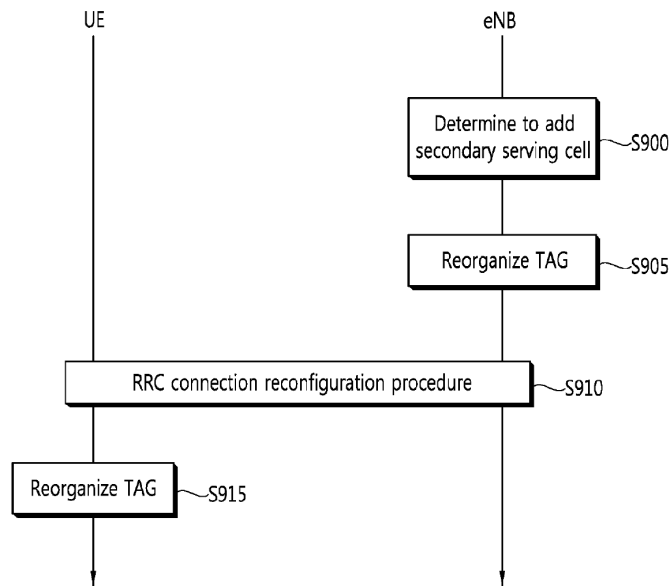
95. The combination of FIGS. 5 and 6 of the ’776 patent provides an illustration of the claimed aspects of the ’776 patent related to releasing and adding serving cells. A base station (eNB in the Figures) may determine to release a secondary serving cell in Step S800 of FIG. 5 in conjunction with determining to add a (presumably different) secondary serving cell in Step S900 of FIG. 6. The removal of a secondary cell and the addition of another secondary cell implies the need to reorganize the Timing Advance Group, which is shown in step S805 in

conjunction with the analogous step of FIG 6, i.e., step S905. The above decisions made by the base station need to be communicated to the user equipment (UE) which is accomplished by transmitting (by the base station) and receiving (by the UE) a corresponding RRC message as shown in steps S810 and S910.

96. To release a serving cell, the RRC message includes a “sCellToReleaseList,” which “indicates the index of a secondary serving cell ‘SCellIndex’ to be released.” *Id.*, 14:11-34. To add a serving cell, the RRC message includes a “sCellToAddModList,” which “indicates the index of the secondary serving cell to be added ‘SCellIndex’” and can include “a TAG ID regarding the added secondary serving cell.” *Id.*, 16:61-17:37. “[T]he reorganized TAG configuration information may be included in the secondary serving cell configuration information and transmitted or may be transmitted in an additional field different from that of the secondary serving cell configuration information.” *Id.*, 16:41-60. In response to having received said RRC message, the UE reorganizes the TAG(s) as shown in steps S815 and S915. EX1001 at 13:3–17:43; FIG. 5, FIG. 6.



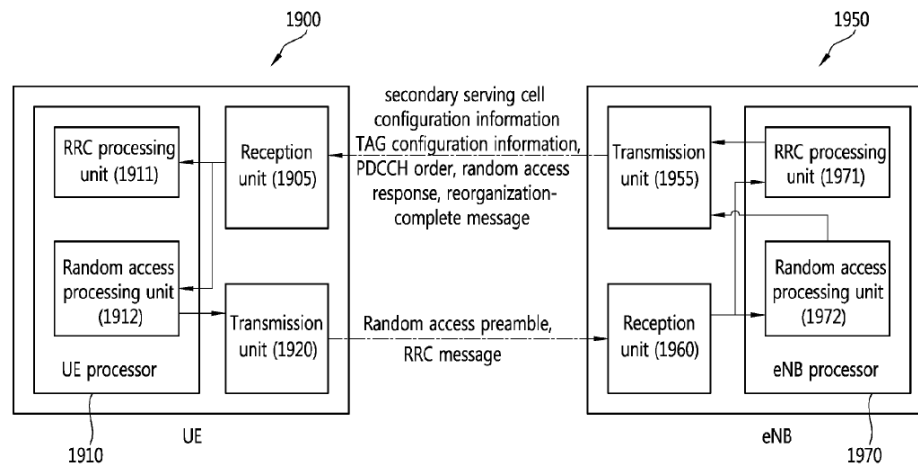
EX1001, FIG. 5



EX1001, FIG. 6

97. FIG. 16 is a block diagram depicting a UE and a BS for sending signals regarding uplink synchronization. EX1001, 3:38–40. Referring to FIG. 16, the UE 1900 includes a reception unit 1905, a UE processor 1910, and a

transmission unit 1920. The UE processor 1910 includes an RRC processing unit 1911 and a random access processing unit 1912. *Id.* at 29:59–62; FIG. 16 (below).



EX1001, FIG. 16

98. The reception unit 1905 receives secondary serving cell configuration information, TAG configuration information, a PDCCH order, an RAR message, and a reorganization-complete message from an eNB 1950. The reorganization-complete message can be at least one of an RAR message including a timing advance value, an RRC connection reconfiguration message, and a PDCCH order. *Id.* at 29:63–30:2.

99. The RRC processing unit 1911 configures a primary serving cell and at least one secondary serving cell in the UE 1900 in the form of the carrier aggregation (CA). A procedure for additionally configuring a secondary serving cell in the UE 1900 or releasing a secondary serving cell configured in the UE 1900 can be indicated by secondary serving cell configuration information. *Id.* at 30:11–17.

100. The RRC processing unit 1911 can reorganize a TAG based on at least one of secondary serving cell configuration information and a TAG ID indicated by TAG configuration information. The RRC processing unit 1911 can reorganize the TAG so that the secondary serving cell is included in the TAG. If the secondary serving cell configuration information includes a field for releasing or adding a specific secondary serving cell, the RRC processing unit 1911 can release or add the specific secondary serving cell based on the RRC message and update or reorganize a TAG to or from which the specific secondary serving cell is added or released. *Id.* at 30:18–29.

101. If the TAG configuration information indicates that a specific secondary serving cell is mapped to a TAG having a specific ID, the RRC processing unit 1911 can reorganize the specific secondary serving cell into the TAG having the specific ID based on the TAG configuration information. *Id.* at 30:30–35.

102. The eNB 1950 includes a transmission unit 1955 that sends secondary serving cell configuration information, TAG configuration information, a PDCCH order, and an RAR to the UE 1900. The transmission unit 1955 may send the secondary serving cell configuration information including the TAG configuration information or may send the TAG configuration information separately from the secondary serving cell configuration information. *Id.* at 31:23–34.

B. Priority Date of the Challenged Claims of the '776 Patent

103. I understand that the applicable date of the Challenged Claims of the '776 patent for prior art purposes depends on whether the features recited in the Challenged Claims of the '776 Patent are described in the application or applications to which priority is claimed. I also understand the claims of the '776 patent have priority on a claim-by-claim basis to the earliest-filed application of the priority chain in which the claimed features are described. For purposes of this Declaration, I have assumed that the Challenged Claims are entitled to the earliest possible priority date, namely March 23, 2012. My opinions set forth in this Declaration would not change if the priority date of the Challenged Claims was determined to be later than March 23, 2012, because all of the prior art set forth in the grounds of unpatentability predate the earliest priority date of March 23, 2012.

C. The Prosecution History

104. I understand that the application leading to the '776 patent (i.e. U.S. Patent Application Serial No. 15/338,993) was filed on October 31, 2016, with twelve original claims. EX1002 at 83–85, 112–115.

105. I understand that the claims were not rejected as being anticipated or obvious in view of any prior art, but rather only some of the claims were rejected for obviousness-type double-patenting in view of the issued claims of U.S. Patent No. 8,964,645 (“the '645 patent”), which issued from the immediately preceding

application of which the '993 application is a continuation. *Id.* at 213–220. I understand that, after a terminal disclaimer was filed (*id.* at 245–246), a Notice of Allowance issued on April 27, 2017. *Id.* at 285–291. The Examiner provided the following statement of reasons for allowance: “the prior art fails to teach or suggest a user equipment (UE) comprising a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and to add the one or more SCell as an available SCell for use with the UE and to associate the one or more SCell with another available SCell associated with same TAG identifier, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value, in combination with other limitations, as specified in the independent claims 1 and 5.” *Id.* at 285–291. As addressed in detail below, in my opinion, prior art which was not of record, and, therefore, not considered by the Examiner, discloses such feature and renders the Challenged Claims unpatentable.

106. A Notice of Abandonment was sent on August 16, 2017. EX1002 at 300. The same day, Applicant petitioned to revive the application and paid the issue fee. *Id.* at 307–316. The '776 patent issued on September 19, 2017. *Id.* at 317.

D. The Challenged Claims of the '776 Patent

107. The '776 patent includes twelve claims. In this Declaration, I have considered the validity of claims 1–8. In my opinion, claims 1–8 of the '776 patent

are anticipated and would have been obvious to a POSITA in view of the prior art references as discussed below.

108. Claims 1–8 are set forth below with annotations identifying the various elements of the claims. In my opinion, the limitations of claims 5–8 substantially correspond to those of claims 1–4, respectively.

	Claim		Claim
[1pre]	1. A user equipment (UE) comprising:	[5pre]	5. A method of user equipment (UE), comprising:
[1a]	a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex and	[5a]	receiving, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex
[1b]	a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and	[5b]	receiving, from the base station, a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and
[1c]	an identifier of a timing advance group (TAG) associated with the one or more SCell;	[5c]	an identifier of a timing advance group (TAG) associated with the one or more SCell;
[1d]	a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and	[5d]	releasing the SCell associated with the first SCellIndex for use with the UE;

	Claim		Claim
[1e]	to add the one or more SCell as an available SCell for use with the UE and	[5e]	adding the one or more SCell as available SCell for use with the UE; and
[1f]	to associate the one or more SCell with another available SCell associated with same TAG identifier,	[5f]	associating the one or more SCell with another available SCell associated with same TAG identifier,
[1g]	wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.	[5g]	wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.
[2]	2. The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG	[6]	6. The method of claim 5, further comprising: associating an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG.
[3]	3. The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message.	[7]	7. The method of claim 5, wherein the first and second field are received through a Radio Resource Control (RRC) connection reconfiguration message.
[4]	4. The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE.	[8]	8. The method of claim 5, further comprising: receiving, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE.

VII. LEVEL OF ORDINARY SKILL IN THE ART

109. In my opinion and based upon my background and experience, the level of skill of a POSITA in the timeframe prior to March 23, 2012, would have been met by a person who would have had a B.S. in Electrical Engineering or a related field with at least three years of experience designing, developing, analyzing and/or testing wireless communication systems. A POSITA would also have familiarity with wireless standards and well-known protocols used in wireless networks. In my opinion, additional education could substitute for professional, practical experience and vice versa. In my opinion, the Challenged Claims of the '776 patent are unpatentable as being anticipated and obvious in view of the prior art references as set forth herein from the perspective of a person with any other level of ordinary skill that is reasonable.

VIII. CONSTRUCTION OF CLAIM TERMS

110. For purposes of the Declaration, it is my understanding that I am to interpret the claim language according to its ordinary and customary meaning that it would have to a POSITA as of the priority date of the Challenged Claims of the '776 patent in the context of the entire patent disclosure. It is my understanding that, in interpreting the claim language, I am to take into consideration the teachings of the patent specification and any relevant prosecution history.

111. With respect to the claim terms of the Challenged Claims, I have applied their plain and ordinary meaning and/or have applied my understanding of how Patent Owner has applied the Challenged Claims in the co-pending district court litigation asserting infringement of the '776 patent. *See* EX1020. In my opinion, the Challenged Claims of the '776 patent are unpatentable in view of the prior art references discussed below under any reasonable interpretation of the claim terms and under the manner in which Patent Owner has applied these claims. *See id.*

IX. OVERVIEW OF THE PRIOR ART

A. Dinan (EX1009)

112. Dinan is a U.S. patent application that published on July 25, 2013, from patent application 13/748,586 (“the '586 application”), which was filed on January 24, 2013. EX1009 at 1. The '586 application claims priority to provisional application No. 61/590,366 (“the '366 provisional application”), which was filed on January 25, 2012. EX1009 at 1. As explained below, in my opinion, the '366 provisional application describes the relied-upon subject matter of Dinan and provides written description support for at least one published claim of Dinan. Thus, I understand that Dinan qualifies as prior art to the Challenged Claims of the '776 patent under at least pre-AIA 35 U.S.C. § 102(e) because it is a patent

application publication that was filed by another before the earliest claimed priority date of March 23, 2012, of the '776 patent.

113. As made clear throughout the specification, Dinan was written in the context of implementing its features within the framework of existing 3GPP LTE technical specifications. EX1009, [0029]; EX1010 at 11–12. Dinan discloses systems for carrier groups in multicarrier networks. A base station transmits control messages to a wireless device configuring secondary cells, each of which is assigned to a cell group. EX1009 at Abstract. The identity or index of a timing advance group to which a serving cell (SCell) belongs, i.e., a TA group identity (TAG ID), is assigned.

114. Dinan discloses that a TAG identifier (TAG ID) associated with a secondary cell (SCell) is transmitted from a base station to a UE. Dinan discloses that TAG configuration may be included in an RRC message (sCellToAddModList) that includes the TAG ID. EX1009 at [0077]; EX1010 at 30–31. The specifics of the TAG configurations disclosed by Dinan are further discussed below in Section X.A.

115. In my opinion, the '366 provisional application provides written support (as shown below) for at least one published claim of Dinan, e.g., Claim 1.

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
1. A method comprising:	E.g., EX1010 at 65, Claim 1[preamble]: 1. A method for operating a base station in a communication network comprising a plurality of base stations, each base station communicating with a plurality of wireless devices and comprising a plurality of cells; each cell comprising a downlink carrier and zero or one uplink carrier, and transmission time is divided into a plurality of frames, and each frame in said plurality of frames is further divided into a plurality of subframes, said method comprising:	
a) transmitting, by a base station configured to communicate employing a plurality of cells, at least one control message to a wireless device in a plurality of wireless devices, said at least one control message:	E.g., EX1010 at 65, Claim 1[preamble], 1a), 1c): 1. A method for operating a base station in a communication network comprising a plurality of base stations, each base station communicating with a plurality of wireless devices and comprising a plurality of cells; ...	E.g., EX1010 at 12: “A base station may include many cells. A cell could be categorized as a primary cell or secondary cell.” E.g., EX1010 at 15: “The resources allocated to each UE and PUCCH configuration is transmitted via control messages.” E.g., EX1010 at 29-30: “The mapping of each serving cell to a TA group may be configured by the serving eNB with RRC signaling. The mechanism for TAG configuration and

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
	c) transmitting at least one control message to said wireless device on said primary downlink carrier; based at least in part on the information in said plurality of radio capability parameters, said at least one control message configuring:	reconfiguration could be based on RRC signalling. When needed, the mapping between an SCell and a TA group may be reconfigured with RRC signaling. For example if there is a need to move an SCell from an sTAG to a pTAG, an RRC signaling, for example an RRC reconfiguration message, may be send to the UE to reconfigure TAG configurations.”
i) configured to cause in said wireless device:	E.g., EX1010 at 65, Claim 1c): c)... said at least one control message configuring:	E.g., EX1010 at 15 E.g., EX1010 at 29-30 See 1a)
(1) configuration of at least one secondary cell in said plurality of cells; and	E.g., EX1010 at 65, Claim 1c)i), 1c)ii): c)... said at least one control message configuring: i) a plurality of cell groups; said plurality of cell groups comprising:... (2) a secondary cell group comprising at least one secondary cell in said at least one secondary cell; and ii) said at least one secondary cell;	E.g., EX1010 at 29-30: “The mapping of each serving cell to a TA group may be configured by the serving eNB with RRC signaling. The mechanism for TAG configuration and reconfiguration could be based on RRC signalling. When needed, the mapping between an SCell and a TA group may be reconfigured with RRC signaling. For example if there is a need to move an SCell from an sTAG to a pTAG, an RRC signaling, for example an RRC reconfiguration message, may be send to the UE to reconfigure TAG configurations.” ...

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		“eNB may relocate this TA-changed serving cell to other existing TAGs. Or alternatively, the eNB may create a new TAG for the SCell, based on the updated TA value. TA value could be derived for example through eNB measurement of signal reception timing, RACH mechanism, or other standard or proprietary algorithms. An eNB may realize that the TA value of a serving cell is no longer consistent with its current TAG. There could be many other scenarios which require eNB to reconfigure TAGs. During reconfiguration, the eNB may need to move the reference SCell belong to an sTAG to another TAG.”
(2) assignment of each of said at least one secondary cell to a cell group in a plurality of cell groups, said plurality of cell groups comprising:	E.g., EX1010 at 65, Claim 1c)i), 1c)ii): c)... said at least one control message configuring: i) a plurality of cell groups; said plurality of cell groups comprising:... (2) a secondary cell group comprising at least one secondary cell in said at least one secondary cell; and ii) said at least one secondary cell;	E.g., EX1010 at 12: “A base station may include many cells. A cell could be categorized as a primary cell or secondary cell. When carrier aggregation is configured, a wireless device may have one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS (non-access stratum) mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC). Depending on wireless device capabilities, Secondary Cells (SCells) could be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC). An SCell may or may not have an uplink carrier.” EX1010 at 26-27: “Serving cells having uplink to which the same time alignment (TA) applies and using the same timing reference could be grouped in a TA group (TAG). For a given TAG, a UE may use one downlink carrier as the timing reference at a given time. For a given TAG, a UE may synchronize uplink subframe and frame transmission timing of the uplink carriers belonging to the same TAG. In an example embodiment, serving cells having uplink to which the same TA applies may correspond to the serving cells hosted by the same

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		receiver. Each TA group comprises at least one serving cell with configured uplink. AUE supporting multiple TAs may support two or more TA groups. One TA group contains the PCell and may be called primary TAG (pTAG). At least one TA group may not contain the PCell and may be called secondary TAG (sTAG). Carriers within the same TA group may use the same TA value and the same timing reference.” EX1010 at 30: “In an example embodiment, when an eNB performs SCell addition configuration, the related TAG configuration may be configured. eNB may modify TAG configuration by reconfiguring SCell parameters. An eNB may perform initial configuration based on an initial configuration parameters received from a network node, for example a management platform, or an initial eNB configuration, or based on UE location, or UE type. Initial configuration may also be based on UE channel state measurement. For example depending on the signal strength received from a UE on various SCells downlink carrier or by determination of UE being in repeater coverage area, or a

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		combination of both, an eNB may determine the initial configuration of sTAGs and membership of SCells to sTAGs.” EX1010 at 31: “The identity or index of a TA group which an SCell belongs to, a TA group identity (TAG ID), may be assigned to an SCell.”
(a) a primary cell group comprising a first subset of said plurality of cells, said first subset comprising a primary cell, uplink transmissions by said wireless device in said primary cell group employing a first synchronization signal transmitted on said primary cell; and	E.g., EX1010 at 65, Claim 1c)i)(1): c)... said at least one control message configuring: i) a plurality of cell groups; said plurality of cell groups comprising: (1) a primary cell group comprising at least one cell comprising said primary cell; wherein all uplink transmissions in said primary cell group use a first synchronization signal on said primary downlink carrier as the timing reference; and	E.g., EX1010 at 12: “A base station may include many cells. A cell could be categorized as a primary cell or secondary cell. When carrier aggregation is configured, a wireless device may have one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS (non-access stratum) mobility information (e.g. TA), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC). Depending on wireless device capabilities, Secondary Cells

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		(SCells) could be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC). An SCell may or may not have an uplink carrier.” EX1010 at 27: “In an example embodiment, serving cells having uplink to which the same TA applies may correspond to the serving cells hosted by the same receiver. Each TA group comprises at least one serving cell with configured uplink. A UE supporting multiple TAs may support two or more TA groups. One TA group contains the PCell and may be called primary TAG (pTAG). At least one TA group may not contain the PCell and may be called secondary TAG (sTAG). Carriers within the same TA group may use the same TA value and the same timing reference.”
(b) at least one secondary cell group, a first secondary cell group in said at least one secondary cell group	E.g., EX1010 at 65-66, Claim 1c)i)(2), 1c)ii), 1g): c)... said at least one control message configuring: i) a plurality of cell groups; said plurality of	E.g., EX1010 at 12, 27 See 1a)i)(2)(a) EX1010 at 15-16 EX1010 at 35: “One timing reference may be configured in an sTAG, the timing alignment offset in RAR (random access response)

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
comprising a second subset of said at least one secondary cell, said second subset comprising a reference secondary cell, uplink transmissions in said secondary cell group employing a second synchronization signal on said reference secondary cell as a secondary timing reference; and	cell groups comprising:... (2) a secondary cell group comprising at least one secondary cell in said at least one secondary cell; and ... ii) said at least one secondary cell; configuration for each cell in said at least one secondary cell comprising a plurality of common parameters and a plurality of dedicated parameters; ... wherein for a first secondary cell in said secondary cell group: (1) said plurality of common parameters comprise: (a) a plurality of random access resource parameters; and (b) a time alignment timer value; said time alignment timer value is the same for all cells belonging to said secondary cell group (this could be a part of S1B2); and	or TAC (time alignment command) could be applied to all SCell(s) in the same sTAG. Thus, the eNB could select the most suitable SCell for timing reference and RACH depending on different circumstances. For example, the SCell which has a larger coverage range may be selected as timing reference cell, since larger coverage could provide a more reliable mobility performance and thus reduce the need of re-configuring the timing reference cell. Channel quality of an SCell in an sTAG may be considered for initial SCell timing reference and for reselecting timing reference cell when the TAT associated with the same sTAG expires.”

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
	(2) said plurality of dedicated parameters comprise: (a) a secondary cell group index; (b) an indication identifying if said first secondary cell is a timing reference for said secondary cell group (optional); and (c) an indication identifying if said first secondary cell is a pathloss reference for said secondary cell group (optional); ... g) transmitting at least one time alignment command to said plurality of wireless devices, said time alignment command comprising: i) an amount of time adjustment for signal transmission on all the uplink carriers in said secondary cell group; and ii) said secondary cell group index; wherein all uplink transmissions in said secondary cell group use said second	

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
	synchronization signal transmitted on said first secondary downlink carrier as the timing reference.	
ii) comprising a plurality of dedicated parameters specific to said wireless device, for each of said at least one secondary cell:	E.g., EX1010 at 65, Claim 1c)ii): c)... ii)... configuration for each cell in said at least one secondary cell comprising a plurality of common parameters and a plurality of dedicated parameters; wherein said plurality of common parameters are the same for all wireless devices in said plurality of wireless devices and said plurality of dedicated parameters are wireless device specific	E.g., EX1010 at 31–32: “The parameters related to time alignment may be dedicated to a UE or may be common to all UEs. For example PRACH configuration for the SCell may be common to all UEs. ...Dedicated parameters may comprise downlink dedicated parameters and uplink dedicated parameters. Examples of downlink dedicated parameters are []. Examples of uplink dedicated parameters are []. The names of these variables are self-explanatory and an example definition and format for these variables may be found in the latest release of LTE RRC standard documentations.”
(1) if said plurality of dedicated parameters comprise a cell group index for said secondary cell, assigning said secondary cell to one of said at least one secondary cell group identified by	E.g., EX1010 at 65-66, Claim 1c)ii)(2), 1d), 1g)(ii): c)... ii)... configuration for each cell in said at least one secondary cell comprising a plurality of common parameters and a plurality of dedicated parameters; ... wherein for a first secondary cell	E.g., EX1010 at 31: “The purpose of RRC connection reconfiguration procedure is to modify an RRC connection, e.g. to establish, modify and/or release RBs, to perform handover, to setup, modify, and/or release measurements, to add, modify, and/or release SCells. As part of the procedure, NAS dedicated information may be transferred from E-UTRAN to the UE. If the

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
said cell group index; and	in said secondary cell group: ... (2) said plurality of dedicated parameters comprise: (a) a secondary cell group index; (b) an indication identifying if said first secondary cell is a timing reference for said secondary cell group (optional); and (c) an indication identifying if said first secondary cell is a pathloss reference for said secondary cell group (optional) d) transmitting an activation command to activate said first secondary cell in said secondary cell group; ... g) transmitting at least one time alignment command to said plurality of wireless devices, said time alignment command comprising: i) an amount of time adjustment for signal transmission on all the	received RRC Connection Reconfiguration message includes the sCellToReleaseList, UE performs SCell release. If the received RRC Connection Reconfiguration message includes the sCellToAddModList, UE performs SCell additions or modification. In an example embodiment, TAG configuration may be included in sCellToAddModList and a TAG ID may be included in the TAG configuration. The TA group could be configured when an SCell is added. Thus the configuration of TA group could be seen as part of the SCell addition or modification. In an example embodiment, TAT configuration may be included in common configuration parameters transmitted to a UE. To configure a new TA group, at least eNB may configure TA group index, and TAT length.” ... “SCellToAddModList transmitted to a UE may comprisesCellIndex, physCellid, dl-CarrierFreq, radioResourceConfigCommonSCell, and radioResourceConfigDedicatedSCell. SCellToAddModList transmitted to a UE may further comprise the TAG ID that the SCell belongs to and/or time

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
	uplink carriers in said secondary cell group; and ii) said secondary cell group index	alignment timer value. ... TAG change may be supported by SCell modification in order to avoid deactivation. The identity or index of a TA group which an SCell belongs to, a TA group identity (TAG ID), may be assigned to an SCell. When an SCell is released, the TA configuration may also be implicitly released so it may not be needed to include TAG ID in sCellToReleaseList.” EX1010 at 32: “The TA maintenance for PCell could follow Rel-10 principles. If an SCell applying the TA of PCell is added, the Rel-10 procedures may be reused. In one example embodiment, there is no need to assign a TAG ID for pTAG. SCells configured with the PCell may be grouped implicitly and a TAG ID for pTAG may not be needed or a TAG ID may be assigned implicitly by default. SCells grouped with PCell may be grouped implicitly and a TAG ID for pTAG may not be required. If an SCell is not configured with RACH parameters nor TAG information, it may apply that the SCell belongs to pTAG.”
(2) otherwise, assigning said secondary cell to		E.g., EX1010 at 6: “A base station may include many cells. A cell could be categorized as a primary cell or secondary cell.

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
said primary cell group;		When carrier aggregation is configured, a wireless device may have one RRC connection with the network. At RRC connection establishment/re-establishment/handover, one serving cell provides the NAS (non-access stratum) mobility information (e.g. TAI), and at RRC connection re-establishment/handover, one serving cell provides the security input. This cell is referred to as the Primary Cell (PCell). In the downlink, the carrier corresponding to the PCell is the Downlink Primary Component Carrier (DL PCC) while in the uplink it is the Uplink Primary Component Carrier (UL PCC). Depending on wireless device capabilities, Secondary Cells (SCells) could be configured to form together with the PCell a set of serving cells. In the downlink, the carrier corresponding to an SCell is a Downlink Secondary Component Carrier (DL SCC) while in the uplink it is an Uplink Secondary Component Carrier (UL SCC). An SCell may or may not have an uplink carrier.” EX1010 at 20-21: “Serving cells having uplink to which the same time alignment (TA) applies and using the same

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		timing reference could be grouped in a TA group (TAG). For a given TAG, a UE may use one downlink carrier as the timing reference at a given time. For a given TAG, a UE may synchronize uplink subframe and frame transmission timing of the uplink carriers belonging to the same TAG. In an example embodiment, serving cells having uplink to which the same TA applies may correspond to the serving cells hosted by the same receiver. Each TA group comprises at least one serving cell with configured uplink. A UE supporting multiple TAs may support two or more TA groups. One TA group contains the PCell and may be called primary TAG (pTAG). At least one TA group may not contain the PCell and may be called secondary TAG (sTAG). Carriers within the same TA group may use the same TA value and the same timing reference.” EX1010 at 32: “The TA maintenance for PCell could follow Rel-10 principles. If an SCell applying the TA of PCell is added, the Rel-10 procedures may be reused. In one example embodiment, there is no need to assign a TAG ID for pTAG. SCells configured with the PCell may be

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
		grouped implicitly and a TAG ID for pTAG may not be needed or a TAG ID may be assigned implicitly by default. SCells grouped with PCell may be grouped implicitly and a TAG ID for pTAG may not be required. If an SCell is not configured with RACH parameters nor TAG information, it may apply that the SCell belongs to pTAG.”
b) transmitting, by said base station, a control command configured to cause transmission of a random access preamble on random access resources of a secondary cell in said secondary cell group; and	E.g., EX1010 at 65-66, Claim 1c)ii, 1d), 1e), 1f): d) transmitting an activation command to activate said first secondary cell in said secondary cell group; e) transmitting a PDCCH order for transmission of a random access preamble on a first secondary uplink carrier of said first secondary cell; said PDCCH order comprising: i) a mask index; ii) a preamble identifier; and iii) said first secondary cell index (optional); f) receiving said random access preamble on said random access resource from said wireless device on said first secondary	E.g., EX1010 at 18-21 EX1010 at 19: “In an example embodiment, the random access procedure could be initiated by a physical downlink control channel (PDCCH) order or by the MAC sublayer in the wireless device. If a wireless device receives a PDCCH transmission consistent with a PDCCH order masked with its radio identifier, it may initiate a random access procedure. Preamble transmission on physical random access channel (PRACH) could be supported on the first uplink carrier and reception of a PDCCH order could be supported on the first downlink carrier.” EX1010 at 19: “Before the wireless device initiates transmission of a random access preamble, it may access one or many of the following information: ...These parameters may be

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
	uplink carrier; the timing of said random access preamble is determined based on a second synchronization signal transmitted on a first secondary downlink carrier of said first secondary cell;	updated from upper layers or may be received from the base station before each random access procedure is initiated. The wireless device may select a random access preamble using the available information. The preamble may be signaled by the base station or it may be randomly selected by the wireless device.” EX1010 at 27: “To obtain initial UL (uplink) time alignment for a sTAG, eNB may initiate RA (random access) procedure.” EX1010 at 51-53
c) transmitting, by said base station, a random access response, said random access response comprising a timing advance command for said secondary cell group.	E.g., EX1010 at 66, Claim 1f), 1g): f) receiving said random access preamble on said random access resource from said wireless device on said first secondary uplink carrier; the timing of said random access preamble is determined based on a second synchronization signal transmitted on a first secondary downlink carrier of said first secondary cell; and g) transmitting at least one time alignment command to said	E.g., EX1010 at 27: “To obtain initial UL (uplink) time alignment for a sTAG, eNB may initiate RA (random access) procedure. The timing reference for all SCells in an sTAG may be the SIB2 linked downlink of the SCell on which the preamble for the latest RA procedure was sent. There may be one timing reference and one time alignment timer (TAT) per TA group and each TAT may be configured with a different value.” EX1010 at 35: “One timing reference may be configured in an sTAG, the timing alignment offset in RAR (random

DINAN (EX1009)	DINAN PROVISIONAL (EX1010)	
CLAIM 1	Claim 1	Specification
	plurality of wireless devices, said time alignment command comprising: i) an amount of time adjustment for signal transmission on all the uplink carriers in said secondary cell group; and ii) said secondary cell group index; wherein said at least one time alignment command substantially aligns uplink transmissions in frames and subframes of said secondary cell group by said plurality of wireless devices and wherein all uplink transmissions in said secondary cell group use said second synchronization signal transmitted on said first secondary downlink carrier as the timing reference.	access response) or TAC (time alignment command) could be applied to all SCell(s) in the same sTAG. Thus, the eNB could select the most suitable SCell for timing reference and RACH depending on different circumstances. For example, the SCell which has a larger coverage range may be selected as timing reference cell, since larger coverage could provide a more reliable mobility performance and thus reduce the need of re-configuring the timing reference cell. Channel quality of an SCell in an sTAG may be considered for initial SCell timing reference and for reselecting timing reference cell when the TAT associated with the same sTAG expires.” EX1010 at 53-55.

116. In my opinion, the ’366 provisional application describes the relied-upon subject matter of Dinan, as indicated by my parallel citations to the ’366 provisional application in my analysis in Section X.A below where I will provide additional details concerning the teachings of Dinan.

B. TS36.331 V10.4.0 (EX1005)

117. TS36.331 V10.4.0 (“TS36.331”) is a Technical Specification published by the 3rd Generation Partnership Project (3GPP) in December 2011. EX1005 at 1. I understand that TS36.331 qualifies as prior art to the Challenged Claims of the ’776 patent under at least pre-AIA 35 U.S.C. § 102(a) because it is a printed publication that published before the earliest priority date of March 23, 2012, of the ’776 patent. *See also*, EX1004, ¶¶22, 68-81.

118. TS36.331 discloses instructions to the UE to add and release serving cells via a “*sCellToReleaseList*” and a “*sCellToAddModList*,” respectively which are contained in an *RRCConnectionReconfiguration* message. EX1005 at 60, 126-127. TS36.331 provides the detailed specifications of the RRC protocol in LTE. As such, it includes the detailed structure of all RRC messages and related procedures. At the earliest claimed priority date of the ’776 patent, a POSITA would have been very familiar with the 3GPP technical specifications and would have considered them to be an important reference to consult when considering any wireless communication system. As an example, it provides the structure and related procedures for a message called “*RRCConnectionReconfiguration*” as mentioned above, which contains, among other things, the disclosure of lists that comprise a serving cell (SCell) index to release a SCell associated with that SCell index and that comprise a SCell index to add a SCell associated with the given

SCell index as recited in the Challenged Claims. A portion of the *RRCConnectionReconfiguration* message is included below, and I will return to it in Section X with relevant details.

– *RRCConnectionReconfiguration*

The *RRCConnectionReconfiguration* message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: E-UTRAN to UE

EX1005 at 126

119. As shown in the portion of the Table of Contents below, Section 5.3.5 provides specific information about actions to be taken with respect to the RRC connection reconfiguration message. I note that when the message is referenced in the document, its formal name is used which is, consistent with other messages used in the document, a concatenation of the words and is printed in italics i.e., it is shown as “*RRCConnectionReconfiguration*.”

5.3.5	RRC connection reconfiguration	45
5.3.5.1	General	45
5.3.5.2	Initiation	46
5.3.5.3	Reception of an <i>RRCConnectionReconfiguration</i> not including the <i>mobilityControlInfo</i> by the UE	46
5.3.5.4	Reception of an <i>RRCConnectionReconfiguration</i> including the <i>mobilityControlInfo</i> by the UE (handover)	47
5.3.5.5	Reconfiguration failure	49
5.3.5.6	T304 expiry (handover failure)	49
5.3.5.7	Void	50
5.3.5.8	Radio Configuration involving full configuration option	50

EX1005 at 4

120. I will discuss TS36.331 in greater detail in Section X below.

C. Potevio (EX1007)

121. Potevio is a document published by the 3rd Generation Partnership Project (3GPP) in November 2011⁵, as publication R2-115812. EX1007 at 1. Like Sharp, Potevio also reflects Agenda Item 7.1.2.3 on “Signalling for TA group configuration” as “Document for: Discussion and Decision” at the 3GPP TSG-RAN WG2#76 meeting in San Francisco, November 14-18, 2011, i.e., the RAN WG2 meeting immediately before meeting #77 discussed in the next section with respect to the Sharp document. EX1007 at 1. A list of attendees who attended the November 2011 meeting in San Francisco, including scientists and engineers from many telecom companies—such as Alcatel-Lucent, Broadcom, Huawei, Intel, NEC, Nokia, Pantech, Qualcomm, Samsung, Sharp, and Verizon Wireless, among others—is found at EX1008. Thus, I understand that Potevio qualifies as prior art to the Challenged Claims of the ’776 patent under pre-AIA 35 U.S.C. § 102(a) because it is a printed publication that published before the earliest priority date of March 23, 2012, of the ’776 patent. *See also*, EX1004, ¶¶20, 48-57.

⁵ I note that the document heading has a typographical error and indicates that meeting #76 was held in November 2010. A POSITA would immediately recognize this as a typo, since the first two digits of the document number are used to convey the year in which the meeting took place, i.e., is “11” indicating 2011. Furthermore, this is confirmed by considering the list of participants as shown in EX1008.

122. At the earliest claimed priority date of the '776 patent, a POSITA would have been very familiar with 3GPP publications, such as Potevio, which were Technical Documents known by the name “TDocs” in the industry. A POSITA would have appreciated that TDocs contained specific recommendations on how to modify the body of 3GPP technical specifications in existence and would have considered them to be an important reference to consult.

123. Potevio discloses, among other things, a TAG identifier which is used to associate serving cells associated with the same TAG which includes serving cells having the same timing advance value. In particular, Potevio discloses that “[t]he concept of TA group was introduced to make multi-TA management simple. In principle TA group partitioning is managed by eNB and TA group information is signaled to the UE for TA value application. In this contribution we study how to signal TA group configuration.” EX1007 at 1. A “simple approach is introducing the concept of TA group index and all cells share the same TA value are configured with the same TA group index.” *Id.*

124. Potevio further discloses that “RRC signaling is used to (re)-associate SCell with TA group,” and that doing so is “the most reliable” way among three options that Potevio discloses (RRC, RAR, or MAC CE). *Id.* With respect to delivering the TA group index, Potevio also discloses “RRC signaling is more flexible” than the other two alternatives it identifies “because there is less

restriction for designing RRC signalling than that for designing [the other two alternatives].” *Id.*

125. In conclusion, Potevio proposes, based on their analysis of pros and cons, that a TAG-ID in the form of a “TA group index” be used and this information should be sent via RRC messages: (1) “Proposal 1: Introduce ‘TA group index’ concept, cells with the same TA value share the same TA group index.” and (2) “Proposal 3: RRC signalling is used to (re-)associate SCell with TA group.” EX1007 at 2.

D. Sharp (EX1006)

126. Sharp is a document published by the 3rd Generation Partnership Project (3GPP) in February 2012 as publication R2-120218. EX1006. Sharp reflects Agenda Item 7.1.2.3 on “TA group handling” as “Document for: Discussion and Decision” at the 3GPP TSG-RAN WG2#77 meeting in Dresden, Germany, February 6-10, 2012. EX1006 at 1. A list of attendees who attended the February 2012 meeting in Dresden, including scientists and engineers from many telecom companies—such as Alcatel-Lucent, Broadcom, Huawei, Intel, NEC, Nokia, Pantech, Qualcomm, Samsung, Sharp, and Verizon Wireless, among others—is found at EX1018. Thus, I understand that Sharp qualifies as prior art to the Challenged Claims of the ’776 patent under at least pre-AIA 35 U.S.C. §

102(a) because it is a printed publication that published before the earliest priority date of March 23, 2012, of the '776 patent. *See also*, EX1004, ¶¶21, 58-67.

127. Sharp is another TDoc, as is Potevio. As I discussed above in the context of Potevio, a POSITA would have appreciated that TDocs like Sharp contained specific recommendations on how to modify the body of 3GPP technical specifications in existence and would have considered them to be an important reference to consult.

128. Sharp discloses, among other things, a TAG identifier which is used to associate serving cells associated with the same TAG which includes serving cells having the same timing advance value. In particular, Sharp discloses in a manner similar to Potevio that “RRC signaling is used to (re-)associate SCell with a TA group” EX1006 at 1. In other words, it discloses that a given SCell can be associated with a Time Advance Group (TAG) or it can be re-associated with a TAG, i.e., an association for a SCell can be configured or reconfigured using RRC signaling. Sharp discloses “the way to handle TA group in a multi-TA scenario.” *Id.*

129. Sharp discloses that “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the [uplink (UL)] timing.” *Id.* Sharp discloses that “TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.* Sharp further discloses

that “TAG-ID configuration should be included in the UL configuration of *PhysicalConfigDedicatedSCell*.” EX1006 at 3 (emphasis in the original).

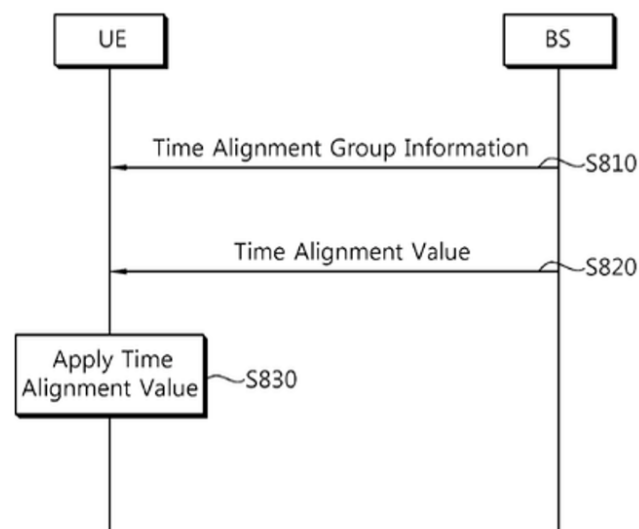
E. Park (EX1011 and EX1012)

130. Park is a WIPO international publication of PCT application PCT/KR2011/000111. Thus, I understand that Park qualifies as prior art to the Challenged Claims of the ’776 patent under at least pre-AIA 35 U.S.C. § 102(a) because it is a patent application publication that published before the earliest priority date of March 23, 2012 of the ’776 patent. Park demonstrates the knowledge of a POSITA and that multiple engineers in the field were arriving at the same solution prior to the earliest priority date of the ’776 patent. I understand EX1012 is a certified English translation of Park. I will cite to the English translation of Park (EX1012) in this Declaration using the Paragraph numbering in Park.

131. As made clear in the Background section, Park was written in the context of the existing 3GPP technical specification framework in existence at the time with a view toward implementation in that framework. Park discloses a UE which “receives information on a time advance group from a base station, and also receives the timing advance command corresponding to the time advance group from the base station.” EX1012 at Abstract. Language to the same effect is also present in Paragraph 10, EX1012, ¶ [0010], wherein the phrase “time alignment

group” corresponds to the “time advance group” mentioned in the Abstract. A POSITA would have understood that these phrases are interchangeable and have the same meaning.

132. Furthermore, Park discloses using TAGs and how they can be conveyed from a base station to a mobile using RRC signaling at least in paragraphs [0086]–[0091]. FIG. 11 of Park depicts, as shown below, a high-level disclosure of a TAG and corresponding TA value.



EX1012, FIG. 11.

133. In his BACKGROUND ART section, Park explains that “there is an ongoing discussion on 3GPP LTE-advanced (LTE-A) that is an evolution of the 3GPP LTE.” EX1012 at [2]. Park discloses that 3GPP LTE-A “employs multiple carriers using carrier aggregation,” for which “there is a need for a method of

maintaining uplink time alignment for a plurality of component carriers [i.e., serving cells].” *Id.* at [3]–[7]. In particular, Park discloses:

The 3GPP LTE-A employs various techniques such as carrier aggregation, relay, etc. The 3GPP LTE system is a single carrier system supporting only one bandwidth (i.e., one component carrier) among {1.4, 3, 5, 10, 15, 20}MHz. On the other hand, the LTE-A employs multiple carriers using carrier aggregation. The component carrier is defined with a center frequency and a bandwidth. The component carrier may correspond to one cell. A multiple carrier system uses a plurality of component carriers having a narrower bandwidth than a full bandwidth.

To decrease interference caused by uplink transmission between user equipments (UEs), it is important for a base station (BS) to maintain uplink time alignment of the UEs. The UE may be located in any area in a cell. An uplink signal transmitted by the UE may arrive to the BS at a different time according to the location of the UE. A signal arrival time of a UE located in a cell edge is longer than a signal arrival time of a UE located in a cell center. On the contrary, the signal arrival time of the UE located in the cell center is shorter than the signal arrival time of the UE located in the cell edge.

To decrease interference between the UEs, the BS needs to performing scheduling so that uplink signals transmitted by the UEs in the cell can be received within a boundary every time. The BS has to properly regulate transmission timing of each UE according to a situation of each UE. Such a regulation is called maintenance of time alignment.

As multiple carriers are introduced, uplink time alignment needs to be maintained in each component carrier (or serving cell). A signaling overhead for maintaining the uplink time alignment may increase in proportion to the number of component carriers.

Accordingly, there is a need for a method of maintaining uplink time alignment for a plurality of component carriers.

EX1012 at [3]–[7].

134. Park makes repeated reference to a problem in the ongoing development of LTE, namely “maintaining uplink time alignment for a plurality of component carriers,” (*id.*, at [7]), and uses terminology well known in LTE (and particularly, TS36.331). *See, for example, id.* at [15], [16], [22]–[33] (including all the Figures referenced therein). Park discloses a solution to this problem, namely techniques for transmitting and receiving a timing alignment command for a plurality of serving cells. *Id.* at [8], [9].

135. Park discloses “a method of grouping serving cells by using similarities in the change of time alignment and managing a timing alignment command for each group.” EX1012 at [83]. In Park’s method, “[g]rouping of the serving cells may be performed by the [base station (BS)].... The BS determines a specific time alignment group to which each serving cell is included, and reports group information to the UE. The group information may be transmitted to the UE by using an RRC message.” *Id.* at [86]. Park’s “time alignment group includes one or more serving cells (or CCs) which use the same time alignment value to maintain uplink time alignment.” *Id.* at [89]. Also, Park’s “time alignment group can be identified by using a time alignment group identifier (ID). The BS may

allocate the time alignment group ID to which the serving cell belongs, when assigning the serving cell to the UE. The UE and the BS determine that serving cells which use the same time alignment group ID are included in the same time alignment group.” *Id.* at [91]; *see also, e.g., id.* at [101]. A POSITA would have appreciated Park’s time alignment techniques for multiple serving cells are suitable for implementation within the 3GPP framework including as disclosed in Dinan and TS36.331.

F. Dinan, TS36.331, Potevio, Sharp, and Park are Analogous Art

136. Each of Dinan, TS36.331, Potevio, Sharp, and Park is analogous art with respect to the ’776 patent. Dinan, TS36.331, Potevio, Sharp, and Park are all in the same field of endeavor as the Challenged Claims of the ’776 patent, namely user equipment in a wireless communication system. *Compare* EX1001, claims 1-8 *with* EX1009, ¶¶[0024], [0027] (“The user 501 may use the wireless device (or UE user equipment) to receive data traffic...”); EX1010 at 10–11, *with* EX1005 at 14 (“The present document specifies the Radio Resource Control protocol for the radio interface between UE and E-UTRAN...”), 19 (“UE” is “User Equipment”), *with* EX1007, 1 (“In principle TA [timing advance] group partitioning is managed by [the base station] and TA group information is signaled to the UE [user equipment] for TA value application.”), *with* EX1006, 3 (“TA group configuration is UE-specific.”), and also *with* EX1012 at [10] (“In an aspect, a method of

receiving a timing advance command by a user equipment in a wireless communication system is provided. The method includes receiving information regarding a time alignment group from a base station, and receiving the timing advance command corresponding to the time alignment group from the base station.”), FIG. 1 (UE 10).

137. Dinan, TS36.331, Potevio, Sharp, and Park are also all reasonably pertinent to the problem faced by the inventor, namely wireless communication in general, and protocols for uplink synchronization in a multiple component carrier system in particular. *Compare* EX1001, 1:19–23 *with* EX1009 at [0018]; EX1010 at 78-79, 85-86, 92-94, *with* EX1005 at 17 (“the term ‘serving cells’ is used to denote the set of one or more cells comprising of the primary cell and all secondary cells”), 60 (“SCell release” and “SCell add/modification”), *with* EX1007 at 1 (“In this contribution we study how to signal TA group configuration.”), *with* EX1006 at 1 (“In this contribution, we would like to discuss the way to handle TA group in a multi-TA scenario.... [Timing Advance] group and [uplink] of SCell in sTAG are mapped by TAG-ID.”), and also *with* EX1012 at paragraphs [2]–[21] at [7] (“[T]here is a need for a method of maintaining uplink time alignment for a plurality of component carriers.”). Dinan is directed to solving the same particular problem as identified in the ’776 patent, namely uplink synchronization in a multiple component carrier system. See, e.g., EX1009 at [0018]; EX1010 at 78-

79, 85-86, 92-94. TS36.331 (EX1005) is directed to operation of a wireless communication system in general, and one including multiple serving cells in particular. A POSITA would have considered TS36.331 pertinent to the problem(s) addressed by the inventors of the '776 patent because it is part of the standard specification by which wireless communication is performed and would have been consulted by, and considered relevant to, a POSITA at the time of the earliest possible priority date of the '776 patent. Potevio (EX1007), Sharp (EX1006), and Park (EX1011, EX1012) are directed to solving the same particular problem as identified in the '776 patent, namely uplink synchronization in a multiple component carrier system. Park specifically refers to the “ongoing discussion of 3GPP LTE-advanced (LTE-A) that is an evolution of the 3GPP LTE.” EX1012, [2]. A POSITA would readily recognize that the reference to “ongoing discussion” and to “LTE-A” is relevant to the Technical Specifications, e.g., to TS36.331 (EX1005).

X. THE CHALLENGED CLAIMS ARE UNPATENTABLE

138. I address below the following Grounds for concluding a POSITA would have found claims 1–8 of the '776 patent obvious:

<u>Ground</u>	<u>References</u>	<u>Challenged Claims</u>
1	Dinan (anticipation)	1-8
2	Dinan (obviousness)	1-8

3	Dinan + Potevio (obviousness)	1-8
4	Dinan + Sharp (obviousness)	1-8
5	TS36.331 + Sharp	1-8

A. Grounds 1 & 2: Claims 1–8 Are Anticipated by, and At Least Would Have Been Obvious in View of, Dinan

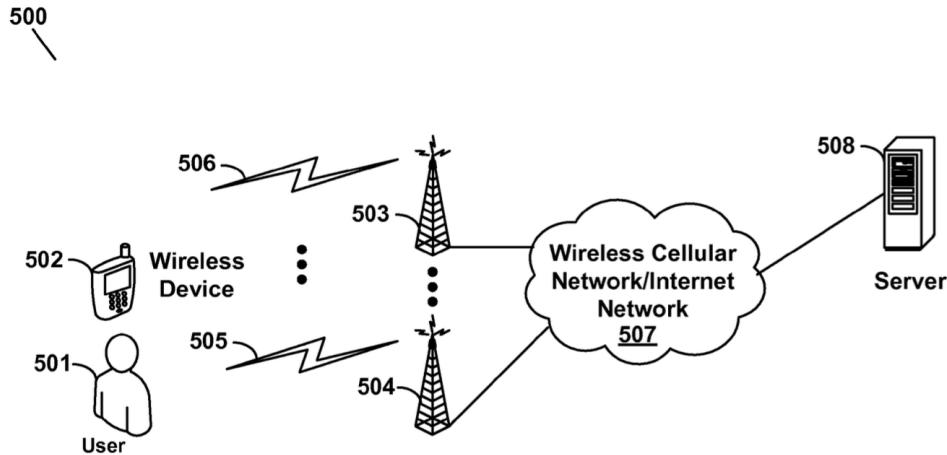
139. In my opinion, claims 1–8 of the ’776 patent are anticipated by Dinan and furthermore would have been obvious to a POSITA in view of Dinan.

1. Independent Claim 1

140. Dinan anticipates claim 1, and claim 1 would have been obvious in view of Dinan.

(a) [1pre] A user equipment (UE)

141. Dinan discloses a user equipment (UE) as recited in Element [1pre]. Dinan discloses a “wireless device” (406 or 502) that is “user equipment.” EX1009 at [0024], [0027] (“The user 501 may use the wireless device (or UE: user equipment) to receive data traffic....”) [0218]; EX1010 at 10–11, 23. Accordingly, Dinan discloses and renders obvious Element [1pre].



EX1009, FIG. 5; EX1010, FIG. 5

- (b) [1a] a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex and

142. Dinan discloses and renders obvious a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex as recited in Element [1a]. Dinan discloses that the UE 406 comprises “at least one communication interface 407” which is a receiver that receives signals from a base station 401. EX1009 at [0024] (“Communication interface 402 in base station 401 may be configured to engage in communication with communication interface 407 in wireless device 406 via a communication path that includes at least one wireless link 411. Wireless link 411 may be a bi-directional link.... Base station 401 and wireless device 406 may be configured to send and receive data over wireless link 411 using multiple frequency carriers. ”), FIG. 4; EX1010 at 10, FIG. 4.

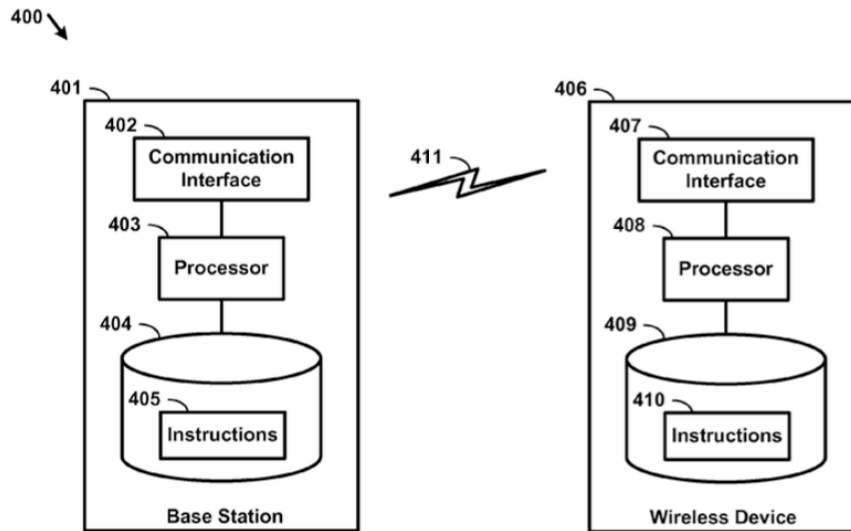


FIG. 4

EX1009, FIG. 4; EX1010, FIG. 4.

143. Dinan discloses that the purpose of an RRC connection reconfiguration procedure includes modifying an RRC connection between a base station and a UE, such as, “to add, modify and/or release SCells.” EX1009 at [0074]; EX1010 at 30. Dinan discloses the use of a field, the *sCellToReleaseList*, in an RRC Connection Reconfiguration Message transmitted from a base station to release a serving cell (SCell): “If the received RRC Connection Reconfiguration message includes the *sCellToReleaseList*, the UE may perform an SCell release.” *Id.*

144. The *sCellToReleaseList* field disclosed in Dinan is the same field that was later disclosed in the ’776 patent for performing the function of releasing SCells. *See, e.g.*, EX1001, 14:11-34 (“The secondary serving cell configuration information for releasing the secondary serving cell is *sCellToReleaseList*.”);

26:28-31 (“If the secondary serving cell configuration information includes a field ‘sCellToReleaseList’, the secondary serving cell configuration information is for releasing the secondary serving cell.”). A POSITA would have understood that Dinan’s and the ’776 patent’s use of the same term “sCellToReleaseList” refers to the same field. The ’776 patent confirms that the sCellToReleaseList field includes a SCellIndex. EX1001, 14:11-34 (“sCellToReleaseList indicates the index of a secondary serving cell ‘SCellIndex’ to be released.”).

145. A POSITA would have understood that the *sCellToReleaseList* field is an existing field in the art, namely a field described in TS36.331. See, e.g., EX1005, 46, 60, 126-127; EX1010, 32 (“The names of these variables are self-explanatory and an example definition and format for these variables may be found in the latest release of LTE RRC standard documentations.”). Dinan and the ’776 patent disclose using the *sCellToReleaseList* field according to its established manner, namely to release a serving cell indicated by each SCellIndex included in the *sCellToReleaseList* field. A POSITA would have understood that the *sCellToReleaseList* field disclosed in Dinan and the same field in the ’776 patent have the same content and the same function, which were known to a POSITA at the time of the earliest claimed priority date of the ’776 patent.

146. The name of the field that indicates the releasing of the SCells—the “sCellToReleaseList” field—itself discloses to a POSITA that it is a list including

a SCellIndex for each SCell to be released. See, e.g. EX1010, 32 (“The names of these variables are self-explanatory.”). So, the name of the *sCellToReleaseList* field in Dinan discloses to a POSITA that this field includes a SCellIndex to identify the SCell to be released as this is the conventional manner in which the *sCellToReleaseList* field is populated. EX1005, 46, 60, 126-127.

147. A POSITA would have understood that Dinan’s use of the unique nomenclature of TS36.331, namely the “sCellToReleaseList” field, was a reference to, and disclosure of, the TS36.331 protocol. As explained below, *see* Section X.D., this includes the use of an SCell index as recited in Element [1a]. As such, a POSITA would have understood that Dinan discloses a UE that includes a receiver to receive a RRC Connection Reconfiguration message including a *sCellToReleaseList* field comprising a serving cell index (SCellIndex) to identify the serving cell to be released.

148. This is reinforced by Dinan’s disclosure of an SCellIndex in a SCellToAddModList field in communication messages between a base station and a UE in connection with adding a SCell: “When a UE receives an sCellToAddModList in an RRC reconfiguration message, the UE may process the content of the message. The UE may, for an sCellIndex value included in the sCellToAddModList that is not part of the current UE configuration (SCell addition), add the SCell corresponding to the cell identification.” EX1009 at

[0075]; EX1010 at 29–32. A POSITA would have understood, and found it obvious, that a sCellIndex was also used in the sCellToReleaseList disclosed in Dinan in a similar manner as the sCellIndex expressly described in connection with the sCellToAddModList.

149. Furthermore, to the extent Dinan does not do so, TS36.331 expressly discloses a “SCellIndex” that “concerns a short identity, used to identify an SCell.” EX1005 at 210. A POSITA at the time of the earliest priority date of the ’776 patent, and through to the present, would have considered the standard documents, including TS36.331, to be an important and fundamental part of their knowledge for consideration in every application. Operability in view of the 3GPP standards would have been an important consideration for any research or commercial project.

150. TS36.331 discloses that “SCell” is an abbreviation for secondary cell. EX1005 at 18. TS36.331 discloses that “For a UE in RRC_CONNECTED configured with [carrier aggregation (CA)] the term ‘serving cells’ is used to denote the set of one or more cells comprising of the primary cell and all secondary cells.” EX1005 at 17; *see also id.* at 19 (4.2.1 UE states and state transitions) (“A UE is in RRC_CONNECTED when [a Radio Resource Connection (RRC)] connection has been established.”).

151. TS36.331 describes a process for receiving from a base station an RRC message with a field (the “*sCellToReleaseList*”) including an *SCellIndex* to identify an associated SCell to be released. EX1005 at 46 (5.3.5.3 Reception of an *RRCCONNECTIONRECONFIGURATION* ... by the UE) (“[T]he UE shall:... 1>if the received *RRCCONNECTIONRECONFIGURATION* includes the *sCellToReleaseList*. 2>perform SCell release as specified in 5.3.10.3a.”), 60 (5.3.10.3a SCell release) (see below). TS36.331 discloses, for each *SCellIndex* value included in the *sCellToReleaseList*, the UE shall release the SCell with the *SCellIndex* value. *Id.* at 60 (5.3.10.3a SCell release) (see below).

5.3.10.3a SCell release

The UE shall:

- 1> if the release is triggered by reception of the *sCellToReleaseList*:
- 2> for each *sCellIndex* value included in the *sCellToReleaseList*:
- 3> if the current UE configuration includes an SCell with value *sCellIndex*:
- 4> release the SCell;
- 1> if the release is triggered by RRC connection re-establishment:
- 2> release all SCells that are part of the current UE configuration;

EX1005 at 60.

152. The *sCellToReleaseList* can be included in an *RRCCONNECTIONRECONFIGURATION* message, as shown below, specifically in the portions highlighted in blue:

– ***RRCConnectionReconfiguration***

The *RRCConnectionReconfiguration* message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCCH

Direction: E-UTRAN to UE

RRCConnectionReconfiguration message

```
-- ASN1START
RRCConnectionReconfiguration ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions              CHOICE {
        c1                         CHOICE {
            rrcConnectionReconfiguration-r8      RRCConnectionReconfiguration-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture      SEQUENCE {}
    }
}

RRCConnectionReconfiguration-r8-IEs ::= SEQUENCE {
    measConfig              MeasConfig              OPTIONAL, -- Need ON
    mobilityControlInfo      MobilityControlInfo      OPTIONAL, -- Cond HO
    dedicatedInfoNASList     SEQUENCE (SIZE(1..maxDRB)) OF
        DedicatedInfoNAS              OPTIONAL, -- Cond nonHO
    radioResourceConfigDedicated RadioResourceConfigDedicated OPTIONAL, -- Cond HO-toEUTRA
    securityConfigHO          SecurityConfigHO        OPTIONAL, -- Cond HO
    nonCriticalExtension      RRCConnectionReconfiguration-v890-IEs OPTIONAL
}

RRCConnectionReconfiguration-v890-IEs ::= SEQUENCE {
    lateNonCriticalExtension      OCTET STRING          OPTIONAL, -- Need OP
    nonCriticalExtension          RRCConnectionReconfiguration-v920-IEs OPTIONAL
}

RRCConnectionReconfiguration-v920-IEs ::= SEQUENCE {
    otherConfig-r9              OtherConfig-r9          OPTIONAL, -- Need ON
    fullConfig-r9                ENUMERATED {true}        OPTIONAL, -- Cond HO-
    Reestab                      Reestab                  OPTIONAL,
    nonCriticalExtension          RRCConnectionReconfiguration-v1020-IEs OPTIONAL
}

RRCConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
    sCellToReleaseList-r10      SCellToReleaseList-r10  OPTIONAL, -- Need ON
    sCellToAddModList-r10       SCellToAddModList-r10   OPTIONAL, -- Need ON
    nonCriticalExtension         SEQUENCE {}              OPTIONAL, -- Need OP
}

SCellToAddModList-r10 ::= SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellToAddMod-r10

SCellToAddMod-r10 ::= SEQUENCE {
    sCellIndex-r10              SCellIndex-r10,
    cellIdentification-r10      SEQUENCE {
        physCellId-r10
    }
}
```

```

        dl-CarrierFreq-r10                ARFCN-ValueEUTRA
    }
    radioResourceConfigCommonSCell-r10    RadioResourceConfigCommonSCell-r10  OPTIONAL,  -- Cond SCellAdd
SCellAdd
    radioResourceConfigDedicatedSCell-r10 RadioResourceConfigDedicatedSCell-r10  OPTIONAL,  --
Cond SCellAdd2
    ...
}

SCellToReleaseList-r10 ::=                SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellIndex-r10

SecurityConfigHO ::=                      SEQUENCE {
    handoverType                          CHOICE {
        intraLTE                          SEQUENCE {
            securityAlgorithmConfig        SecurityAlgorithmConfig  OPTIONAL,  -- Cond
fullConfig
            keyChangeIndicator              BOOLEAN,
            nextHopChainingCount            NextHopChainingCount
        },
        interRAT                          SEQUENCE {
            securityAlgorithmConfig        SecurityAlgorithmConfig,
            nas-SecurityParamToEUTRA       OCTET STRING (SIZE(6))
        }
    },
    ...
}

-- ASN1STOP

```

EX1005 at 126-127.

153. The portions highlighted in blue show that the *SCellToReleaseList* is part of the RRC connection reconfiguration message and it includes a *SCellIndex*, which is an index “used to identify an SCell” to be released. The structure of the *SCellIndex* is shown below:

– *SCellIndex*

The IE *SCellIndex* concerns a short identity, used to identify an SCell.

***SCellIndex* information element**

```

-- ASN1START
SCellIndex-r10 ::=                      INTEGER (1..7)
-- ASN1STOP

```

EX1005 at 210

154. In other words, the one or more *SCellIndex* has a value between 1 and 7 and is used to “identify an SCell” in this case to be released. *See also* EX1005 at 23-24 (5.1.2 General requirements) (“The UE shall:...1>upon receiving a choice value set to *release*: 2> clear the corresponding configuration and stop using the associated resource.”).

155. A POSITA would have found it obvious to incorporate the teachings of TS36.331 to configure Dinan to include a receiver to receive, from a base station, a first field comprising a first serving cell index (*SCellIndex*) to release a serving cell (*SCell*) associated with the first *SCellIndex* as recited in Element [1a]. In particular, a POSITA would have been familiar with TS36.331’s disclosure of using the *SCellIndex* in a *sCellToReleaseList* field to identify SCells to be released and doing so would bring Dinan into compliance with the TS36.331 specification.

156. Additionally, configuring Dinan’s *sCellToReleaseList* field as described in TS36.331 would have yielded predictable results and required nothing more than routine engineering. A POSITA would have been very familiar with TS36.331’s specific details concerning the *sCellToReleaseList* field, and would have found it obvious to incorporate those details into the same *sCellToReleaseList* field referenced in Dinan. A POSITA would have been capable of implementing these details, particularly as Dinan adopts the nomenclature of TS36.331 in describing the relevant field to clearly spell out to a POSITA what would be

modified. A POSITA would have understood that incorporating features of the TS36.331 *sCellToReleaseList* field into the Dinan *sCellToReleaseList* field had a high likelihood of success and was obvious. Accordingly, of Dinan discloses and renders obvious Element [1a].

(c) [1b] a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and

157. Dinan discloses a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex as recited in Element [1b]. Dinan discloses that the purpose of an RRC connection reconfiguration procedure includes “to add ... SCells,” and that “[i]f the received RRC Connection Reconfiguration message includes the *sCellToAddList*, the UE may perform SCell additions or modifications.” EX1009 at [0074], EX1010 at 30.

158. Dinan discloses the *sCellToAddModList* field includes an SCellIndex to identify the SCell to be added: “When a UE receives an *sCellToAddModList* in an RRC reconfiguration message, the UE may process the content of the message. The UE may, for an *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition), add the SCell corresponding to the cell identification....” EX1009 at [0075]; EX1010 at 29–32.

159. Again, the *sCellToAddModList* field disclosed in Dinan is the same field that was later disclosed in the ’776 patent for performing the function of

adding SCells. *See, e.g.*, EX1001, 17:26-37 (the “sCellToAddModList” field “indicates the index of the secondary serving cell to be added ‘SCellIndex.’”); 26:31-35 (“[I]f the secondary serving cell configuration information includes a field ‘sCellToAddModList’, the secondary serving cell configuration information is for adding the secondary serving cell.”). A POSITA would have understood that Dinan’s and the ’776 patent’s use of the same term “sCellToAddModList” refers to the same field.

160. The use of the sCellToAddModList field in Dinan and the ’776 patent is consistent with TS36.331 which describes a process for receiving from a base station an RRC message with a field (the “*sCellToAddModList*”) including an *SCellIndex* to identify at least one associated SCell to be added. EX1005 at 46 (5.3.5.3 Reception of an *RRCCConnectionReconfiguration* ... by the UE) (“[T]he UE shall:... 1>if the received *RRCCConnectionReconfiguration* includes the *sCellToAddModList*. 2> perform SCell addition or modification as specified in 5.3.10.3b.”), 60 (5.3.10.3b SCell addition/modification) (see below).

5.3.10.3b SCell addition/ modification

The UE shall:

- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition):
 - 2> add the SCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*;
 - 2> configure lower layers to consider the SCell to be in deactivated state;
- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is part of the current UE configuration (SCell modification):
 - 2> modify the SCell configuration in accordance with the received *radioResourceConfigDedicatedSCell*;

EX1005 at 60

161. TS36.331 discloses, for each *SCellIndex* value included in the *sCellToAddModList* not part of the current configuration, the UE shall add the SCell with such *SCellIndex* value. *Id.* at 60 (5.3.10.3b SCell addition/modification) (“The UE shall: 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition): 2> add the SCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*.”); *see also id.* at 126-127 (*RRConnectionReconfiguration* message). In this case, the one or more *SCellIndex* is used to “identify an SCell” to be added.

162. Accordingly, Dinan discloses and renders obvious Element [1b].

**(d) [1c] an identifier of a timing advance group (TAG)
associated with the one or more SCell**

163. Dinan discloses an identifier of a timing advance group (TAG) associated with the one or more SCell as recited in Element [1c]. Dinan discloses that “serving cells having an uplink to which the same time alignment (TA) applies may be grouped in a TA group (TAG).” EX1009, [0033]; EX1010, 26-27. “The identity or index of a TA group which an SCell belongs to, a TA group identity (TAG ID), may be assigned to a SCell.” EX1009 at [0077]; EX1010 at 31.

164. Dinan discloses that a TAG identifier (TAG ID) associated with an SCell is transmitted from a base station to a UE in an RRC reconfiguration message in the same field used to add serving cells—the *sCellToAddModList* field. Dinan discloses that TAG configuration may be included in *sCellToAddModList* and a TAG ID may be included in the TAG configuration. EX1009 at [0077]; EX1010 at 30–31. Dinan notes, “SCell TAG configuration(s) (e.g. TAG ID assignment) may be included in *sCellToAddModList* or one of the IEs in *sCellToAddModList*. A TAG ID may be included in the TAG configuration of a cell. The TA group may be configured when an SCell is added.” EX1009 at [0077]; EX1010 at 30–31. The *sCellToAddModList* field transmitted to the UE includes the TAG ID to which the SCell belongs. EX1009 at [0077] (*sCellToAddModList* transmitted to a UE may comprise “the TAG ID that the

SCell belongs to.”) (“A dedicated parameter in SCell dedicated parameters may include the TAG ID of the SCell.”); EX1010 at 31.

165. Accordingly, Dinan discloses Element [1c].

(e) [1d] a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and

166. Dinan discloses a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex as recited in Element [1d]. Dinan discloses that the UE comprises “at least one processor 408” which is used to “process the content of [] message[s]” received, such as RRC reconfiguration messages. EX1009 at [0024], [0026], [0075], FIG. 4; EX1010 at 10-11, 29–31, FIG. 4.

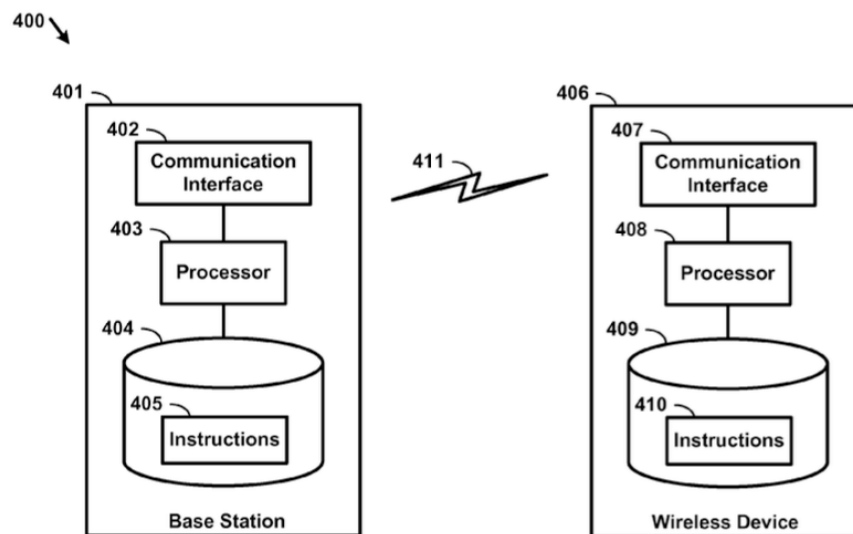


FIG. 4

EX1009, FIG. 4; EX1010, FIG. 4

167. Dinan discloses that the purpose of an RRC connection reconfiguration procedure includes modifying an RRC connection between a base station and a UE, such as, “to ... release SCells.” EX1009 at [0074]; EX1010 at 30. Dinan discloses the use of a field in an RRC Connection Reconfiguration Message transmitted from a base station to release a serving cell (SCell): “If the received RRC Connection Reconfiguration message includes the *sCellToReleaseList*, the UE may perform an SCell release.” *Id.* As explained above, *see* Section X.A.1(b), this includes the use of a SCell index as recited in Element [1a].

168. A POSITA would have understood that the UE includes a RRC processor to perform the operations commanded in the RRC Connection Reconfiguration message and that the RRC Connection Reconfiguration message includes a field comprising a serving cell index (*sCellIndex*) to identify the serving cell to be released. The use of the nomenclature from TS36.331 would have indicated to a POSITA that the TS36.331 protocol was being referenced and disclosed in Dinan. TS36.331 discloses that the *sCellToReleaseList* is included in a “*RRCConnectionReconfiguration*” message that is a “command to modify an RRC connection” sent to the UE and which conveys information for “measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated

dedicated NAS information and security configuration.” EX1005 at 126. The description of the *sCellToReleaseList* field in the ’776 patent confirms this is how a POSITA would have understood Dinan.

169. Further details can be found in the discussion of Element [1a] above at Section X.A.1(b), which is incorporated herein. Accordingly, a POSITA would have understood Dinan discloses and renders obvious a UE including a RRC processor to release the SCell associated with the first SCellIndex as recited in Element [1d].

(f) [1e] to add the one or more SCell as an available SCell for use with the UE and

170. Dinan discloses adding the one or more SCell as an available SCell for use with the UE as recited in Element [1e]. Dinan discloses that the purpose of an RRC connection reconfiguration procedure includes “to add ... SCells,” and that “[i]f the received RRC Connection Reconfiguration message includes the *sCellToAddList*, the UE may perform SCell additions.” EX1009 at [0074]; EX1010 at 30.

171. Dinan discloses: “When a UE receives an *sCellToAddModList* in an RRC reconfiguration message, the UE may process the content of the message. The UE may, for an *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition), add the SCell corresponding to the cell identification in accordance with the received

radioResourceConfigCommonSCell (SCell common configuration parameters) and radioResourceConfigDedicatedSCell (SCell dedicated configuration parameters).” EX1009 at [0075], EX1010 at 29–32. This is consistent with the manner in which the same-named field operates in the ’776 patent. *See, e.g.*, EX1001, 17:26-37 (the “sCellToAddModList” field “indicates the index of the secondary serving cell to be added ‘SCellIndex.’”); 26:31-35 (“[I]f the secondary serving cell configuration information includes a field ‘sCellToAddModList’, the secondary serving cell configuration information is for adding the secondary serving cell.”).

172. See the discussion of Element [1b] at Section X.A.1.(c) for additional details. Accordingly, Dinan discloses Element [1e].

(g) [1f] to associate the one or more SCell with another available SCell associated with same TAG identifier

173. Dinan discloses associating the one or more SCell with another available SCell associated with same TAG identifier as recited in Element [1f]. Dinan discloses “[t]he mapping of a serving cell to a TAG may be configured by the serving eNB with RRC signaling.” EX1009, [0069]; EX1010, 29-30. Dinan discloses “[t]he identity or index of a TA group which an SCell belongs to, a TA group identity (TAG ID), may be assigned to a SCell.” EX1009 at [0077]; EX1010 at 31.

174. Dinan discloses that the SCell is associated with a TAG when the UE processes the sCellToAddModList. Dinan discloses that TAG configuration may be included in sCellToAddModList and a TAG ID may be included in the TAG configuration. EX1009 at [0077]; EX1010 at 30–31. Dinan notes, “SCell TAG configuration(s) (e.g. TAG ID assignment) may be included in sCellToAddModList or one of the IEs in sCellToAddModList. A TAG ID may be included in the TAG configuration of a cell. The TA group may be configured when an SCell is added. Thus the configuration of a TA group may be seen as part of the SCell addition/modification” EX1009 at [0077]; EX1010 at 30–31. The sCellToAddModList transmitted to the UE includes the TAG ID to which the SCell belongs. EX1009 at [0077] (“A dedicated parameter in SCell dedicated parameters may include the TAG ID of the SCell.”); EX1010 at 31.

175. A POSITA would have understood that a TAG may include two or more SCells having the same time alignment. *See, e.g.*, EX1009, [0033]; EX1010, 26-27; EX1001 at 1:54–58 (A TAG is “a group of one or more serving cells having the same timing advance value.”). A POSITA would have understood, and found it obvious, that the one or more SCells being added in Dinan’s sCellToAddModList are respectively associated with any other available SCell associated with same TAG identifier so as to take advantage of the benefits of organizing the SCells into TAGs. As furthermore Dinan explains, using a TAG

has the advantage of reducing “signalling overhead or complexity of implementation and/or increase efficiency”. EX1009, [0173]; See also EX1010, 34.

176. Accordingly, Dinan discloses and renders obvious Element [1f].

(h) [1g] wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value

177. Dinan discloses the TAG being associated with SCells having timing based on the same timing advance (TA) value as recited in Element [1g]. See Element [1f], Section X.A.1(g), above. Dinan discloses that “serving cells having an uplink to which the same time alignment (TA) applies may be grouped in a TA group (TAG).” EX1009, [0033]; EX1010, 26-27. A POSITA would have understood that “timing advance” and “time alignment” have the same meaning in this context.

178. Element [1g] would have been well known to a POSITA at the time of the earliest possible priority date of the '776 patent, as recognized in its Background section. EX1001, 1:54–58 (A TAG is “a group of one or more serving cells having the same timing advance value” and was used in a multiple component carrier system “to effectively perform timing alignment.”). It would have been obvious in view of the knowledge of a POSITA to include in the disclosure of Dinan associating the TAG with SCells having timing based on a same timing advance (TA) value as recited in Element [1g] as this was the commonly understood

organization of a TAG. Accordingly, Dinan discloses and renders obvious Element [1g] and, therefore, claim 1.

2. Dependent Claim 2

- (a) The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG**

179. Dinan discloses the added limitation of Claim 2 that the UE processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG. Dinan discloses, “SCell TAG configuration(s) (e.g. TAG ID assignment) may be included in sCellToAddModList or one of the IEs in sCellToAddModList.... Thus the configuration of a TA group may be seen as part of the SCell addition/modification.” EX1009, [0077]; EX1010, 30-31. Dinan discloses implicitly assigning a SCell to the TAG associated with the PCell (i.e., a “pTAG”) by not including a TAG ID in the sCellToAddModList:

[T]here is no need to explicitly assign a TAG ID for cells in the pTAG. SCells configured with the pTAG may be grouped implicitly and a TAG ID for pTAG may not be needed or a TAG ID may be assigned implicitly by default (for example, TAGID: 0). TAG identity may be regarded as Zero if the TAG identity field is absent in SCell dedicated parameters upon SCell addition. If an SCell is not configured with a TAG ID, it may apply that the SCell belongs to the pTAG.

EX1009, [0080]; EX1010, 32; *see also* EX1009, [0033] (“One TA group may contain the PCell and may be called a primary TAG (pTAG).”); EX1010, 26-27. Accordingly, Dinan discloses and renders obvious Claim 2.

3. Dependent Claim 3

(a) The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message

180. Dinan discloses “the receiver receives the first and second field through a RRC connection reconfiguration message,” as recited in dependent claim 3. Dinan discloses the UE receiver receives the first and second fields as recited in Claim 3 via the sCellToReleaseList and the sCellToAddModList, respectively. *See* Section X.A.1(b), (c).

181. Dinan describes that the purpose of an RRC connection reconfiguration procedure is “to add ... and/or release SCells.” EX1009 at [0074]; EX1010 at 29–32. Dinan discloses the use of an RRC connection reconfiguration message to convey the sCellToReleaseList and the sCellToAddModList. EX1009, [0074] (“If the received RRC Connection Reconfiguration message includes the sCellToReleaseList, the UE may perform an SCell release. If the received RRC Connection Reconfiguration message includes the sCellToAddModlist, the UE may perform SCell additions or modification.”); EX1010, 30-31. For example, Dinan discloses, “When a UE receives an sCellToAddModList in an RRC

reconfiguration message, the UE may process the content of the message. The UE may, for an sCellIndex value included in the sCellToAddModList that is not part of the current UE configuration (SCell addition), add the SCell corresponding to the cell identification.” EX1009 at [0075]; EX1010 at 29–32.

182. Accordingly, Dinan discloses and renders obvious claim 3.

4. Dependent Claim 4

(a) The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE

183. Dinan discloses “the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE,” as recited in dependent claim 4. Dinan discloses the UE receiver receives from the base station a RRC message including the sCellToReleaseList which is “the first field.” EX1009, [0074] (“If the received RRC Connection Reconfiguration message includes the sCellToReleaseList, the UE may perform an SCell release.”); EX1010, 30-31. Dinan discloses and renders obvious the UE receiver receiving, from the base station, the first SCellIndex by way of the sCellToReleaseList field, which is an indication to remove an SCell from SCells available to the UE. *See* Section X.A.1(b).

184. Dinan discloses that releasing a SCell in response to receiving the sCellToReleaseList field removes the SCell from the SCells available to the UE.

For example, Dinan describes an example embodiment where, “eNB may modify the TAG configuration of an SCell by removing (releasing) the SCell and adding a new SCell (with the same physical cell ID and frequency) with an updated TAG ID.” EX1009 at [0070]; EX1010 at 29–32. Dinan continues, “In an example implementation, it may not be possible to change the TAG associated with an SCell, but rather, the SCell may need to be removed and a new SCell may need to be added with another TAG.” *Id.* A POSITA would have understood that the release operation disclosed by Dinan (via the *sCellToReleaseList* field) removes the SCell from SCells available to the UE.

185. Accordingly, Dinan discloses and renders obvious claim 4.

5. Claims 5–8

186. Dinan discloses and renders obvious claims 5–8 for the same reasons as claims 1–4, respectively. See Sections X.A.1-4.

B. Ground 3: Claims 1-8 Would Have Been Obvious in View of Dinan and Potevio

187. In my opinion, claims 1-8 would have been obvious in view of Dinan and Potevio.

1. The Dinan-Potevio Combination

188. It would have been obvious to a POSITA prior to the earliest possible priority date of the ’776 patent to combine Dinan and Potevio to arrive at the subject matter of claims 1-8.

189. A POSITA would have been motivated to combine Dinan and Potevio because they are directed to the same technologies and a skilled artisan would have understood the benefits of combining these references. A POSITA would have understood that there was a high likelihood of success in making the combination.

190. Dinan and Potevio are readily combinable because they are directed to protocols for a radio interface between user equipment and base stations in LTE and in particular about Timing Advance and Timing Advance Groups. Potevio discloses specific ways to signal TA group configuration and to associate an SCell and a TAG. EX1007, 1 (“In this contribution we study how to signal TA group configuration.”). A POSITA would have applied Potevio’s advantageous teachings on handling TAG configurations via the RRC to Dinan.

191. As recognized in the ’776 patent, the concept of a timing advance group was well-known at the time of the earliest claimed priority date. EX1001, 1:54-58. A POSITA would have understood that there was a need for a mechanism to identify different TAGs, and that the simplest and most straightforward way to do so would be with a unique TAG identifier.

192. Furthermore, for example, Sesia explains that “the timing of the PCell and all SCells configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2) is therefore sufficient to control the UE’s uplink transmission timing for **all the uplink CCs** [Component

Carriers] **together.**” EX1015 (Sesia) at 642 (emphasis added). In other words, creating a Timing Advance Group (a TAG) was known to a POSITA at the time of the earliest priority date of the ’776 patent as a POSITA understood at that time that a single TA command would have been used for the entire TAG. Sesia discloses a plurality of SCells having the same TA value, i.e., belonging to the same TAG. Thus, associating one or more SCells with another available SCell having the same TA, and by extension having the same TAG identifier, would have been obvious to a POSITA in view of the state of the art at the time of the earliest priority date of the ’776 patent.

193. Sesia further explains that “Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” EX1015 at 642. It is common sense, and was well within a POSITA’s knowledge at the time of the earliest priority date of the ’776 patent, that the presence of more than one timing advance group (e.g., the already existing TAG plus the new ones to be introduced in Release 11) would necessitate a mechanism to identify a given TAG.

194. A POSITA would have appreciated at the time of the earliest priority date of the ’776 patent that the simplest, most straight-forward way to do so is to assign a unique identifier to a given TAG, e.g., TAG #1, TAG #2, etc. This approach was already being used at that time for purposes of identifying each SCell using the *SCellIndex*. See, e.g., TS36.331 at 210, as shown below.

— *SCellIndex*

The IE *SCellIndex* concerns a short identity, used to identify an SCell.

***SCellIndex* information element**

```
-- ASN1START
SCellIndex-r10 ::=                INTEGER (1..7)
-- ASN1STOP
```

EX1005 at 210

195. Using an index to identify a TAG is a simple extension of the same well-understood principle of using an index (*SCellIndex*) to identify a SCell. Thus, using a unique identifier to identify a specific TAG would have been readily appreciated by a POSITA as suitable for use to identify one of several TAGs each associated with one or more SCells, and a POSITA would have had a high expectation of success in so using a TAG identifier based on the successful use of the *SCellIndex* to identify unique SCells.

196. Potevio confirms this understanding, disclosing “how to signal TA group configuration” and explains why a TA group index helps in that endeavor. EX1007, 1 (“One simple approach is introducing the concept of TA group index [where] all cells [that] share the same TA value are configured with the same TA group index.”); 2 (disclosing a “‘TA group index’ concept, [in which] cells with the same TA value share the same TA group index.”).

197. The specification of the '776 patent notes the need for a “clearly defined” signaling protocol for informing that a secondary cell is included in a TAG, and for informing the UE when a TAG is changed according to a channel condition. EX1001, 1:66-2:5. Potevio discloses such protocol: “Every cell should be associated to a TA group to apply TA value for uplink transmission. The relationship between configured cell and TA group should be configured by eNB, i.e. explicit signalling is necessary to establish mapping between each cell and a TA group.” EX1007, 1. Potevio also discloses using RRC signaling “to (re-) associate SCell with TA group.” EX1007, 2. Potevio explains that the RRC “is the most reliable” among the approaches considered by Potevio and “is more flexible” than the other approaches. *Id.*, 1-2.

198. A POSITA would have looked to such teachings in Potevio, including the use of a TAG identifier and radio resource control (RRC) messaging, to associate the SCell being added with another available SCell associated with same TAG identifier. In view of the teachings in Potevio, a POSITA would have been motivated to use and configure the Dinan UE receiver to receive a TAG-ID for a timing advance group (TAG) associated with one or more SCells having the same timing advance value, and to use and configure the RRC processor to associate the SCell being added with other available SCells for the same TAG identifier.

199. A skilled artisan would have combined Dinan and Potevio, and would have had a reasonable expectation of success in doing so, as the concept of a Timing Advance Group (TAG) was known in the art and was acknowledged as such in the specification of the '776 patent itself. EX1001, 1:54-65. Potevio discloses every cell should be associated with a TAG and RRC signalling should be used “to establish mapping between each cell and a TA group.” EX1007, 1-2. A POSITA would have had a reasonable expectation of success in combining Potevio with Dinan in view of Potevio’s express guidance on how to fix the problem (associating SCells to a TAG). The combination of Dinan and Potevio is merely the predictable use of interchangeable prior art elements according to their established functions. This combination is not one of innovation but of ordinary skill and common sense.

200. The combination of Dinan and Potevio would have yielded predictable results and required nothing more than routine engineering and common sense. Dinan teaches that RRC messages can be used in conjunction with using Timing Advance Groups. *See, e.g.*, EX1009 at [0030]-[0045]; EX1010 at 20-23, 78-79, 85-86, 92-94. Similarly, Potevio teaches that RRC signalling should be used to manage associating cells with TA Groups. *See, e.g.*, EX1007 at 1 (“RRC signalling is used to (re-)associate SCell with TA group” via a “TA group index”). A POSITA would have appreciated that an index was already

successfully used to identify unique SCells, namely by using an SCellIndex, and would work similarly well to identify different TAGs. A POSITA would have only needed to incorporate the additional details from Potevio for use of the RRC to associate the SCell with other available SCells as proposed by Potevio. A POSITA would have been capable of configuring the RRC with a TA group index as an identifier of a timing advance group (TAG) and to use it to associate SCells with the same timing advance (TA) value, which was well within the capabilities of a POSITA prior to the earliest possible effective priority date of the '776 patent. A POSITA would have been capable of configuring the RRC with a TAG identifier of a timing advance group (TAG) and to use it to associate SCells with the same timing advance (TA) value. A POSITA would have understood that this modification had a high likelihood of success and was obvious. Accordingly, the combination of Dinan and Potevio renders the Challenged Claims obvious.

2. Independent Claim 1

201. Claim 1 would have been obvious to a POSITA in view of the combination of Dinan and Potevio.

- (a) [1pre] A user equipment (UE)**
 - [1a] a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex**
 - [1b] a second field comprising at least one SCellIndex**

to add one or more SCell associated with the at least one SCellIndex

202. Dinan discloses and renders obvious Elements [1pre]-[1b], as described above in Sections X.A.1.(a)-X.A.1(c).

(b) [1c] an identifier of a timing advance group (TAG) associated with the one or more SCell

203. Dinan discloses and renders obvious an identifier of a timing advance group (TAG) associated with the one or more SCell as recited in Element [1c]. See the discussion at Section X.A.1(d), incorporated herein.

204. As Sesia [EX1015] explains, the concept of a timing advance group was known in the art. Specifically, Sesia explains that “the timing of the PCell and all SCells configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2) is therefore sufficient to control the UE’s uplink transmission timing for **all the uplink CCs** [Component Carriers] **together.**” EX1015 (Sesia) at 642 (emphasis added). In other words, as recognized in the ’776 patent, creating a Timing Advance Group (a TAG) was known to a POSITA at the time of the earliest priority date of the ’776 patent, and a POSITA understood at that time that a single TA command would have been used for the entire TAG. See EX1001, 1:54–65.

205. Sesia further explains that “Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” EX1015 at

642. It is common sense, and was well within a POSITA's knowledge at the time of the earliest priority date of the '776 patent, that the presence of more than one timing advance group (e.g., the already existing TAG discussed in the above paragraph plus the new ones to be introduced in Release 11) would necessitate a mechanism to identify a given TAG. A POSITA would have readily appreciated at the time of the earliest priority date of the '776 patent that the simplest, most straight-forward way to do so is to assign a unique identifier to a given TAG, e.g., TAG #1, TAG #2, etc. This approach was already being used at that time for purposes of identifying each SCell using the *SCellIndex*. Using an index to identify a TAG is a simple extension of the same well-understood principle of using an index to identify a SCell. Thus, using a unique identifier to identify a specific TAG would have been readily appreciated by a POSITA as suitable for use to identify one of several TAGs each associated with one or more SCells.

206. In addition, Potevio's focal point is a "Need for TA group index." EX1007, 1. Potevio discloses sending an RRC message with a TAG identifier associated with each SCell being added from the base station (eNB) to the receiver of the UE. *Id.* ("Every cell should be associated to a TA group to apply TA value for uplink transmission. The relationship between configured cell and TA group should be configured by eNB, i.e. explicit signalling is necessary to establish mapping between each cell and a TA group. One simple approach is introducing

the concept of TA group index and all cells share the same TA value are configured with the same TA group index.”). Potevio discloses a “‘TA group index’ concept, [in which] cells with the same TA value share the same TA group index.” *Id.* at 2.

207. Potevio discloses using a RRC message to signal TA group configuration. EX1007, 2. Potevio explains that the RRC “is the most reliable” among the approaches considered by Potevio and “is more flexible” than the other approaches considered. *Id.*, 1-2.

208. A POSITA would have been motivated in view of the teachings of Potevio and Dinan to include an identifier of a TAG (in the form of a TA group index) associated with the SCell(s) being added and had a reasonable expectation of success. *See* Section X.B.1. Accordingly, the Dinan-Potevio combination discloses and renders obvious Element [1c].

- (c) **[1d] a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and [1e] to add the one or more SCell as an available SCell for use with the UE and**

209. Dinan discloses and renders obvious Elements [1d]-[1e], as described above in Sections X.A.1.(e)-X.A.1(f).

(d) [1f] to associate the one or more SCell with another available SCell associated with same TAG identifier

210. Dinan discloses and renders obvious associating the one or more SCell with another available SCell associated with same TAG identifier as recited in Element [1f]. See the discussion at Section X.A.1(g), incorporated herein.

211. In addition, Potevio also discloses Element [1f]. The discussion of Element [1c] above in Section X.B.2.(b) is incorporated herein.

212. Potevio discloses, “Every cell should be associated to a TA group to apply TA value for uplink transmission. The relationship between configured cell and TA group should be configured by eNB, i.e. explicit signalling is necessary to establish mapping between each cell and a TA group.” EX1007, 1. Potevio also discloses using RRC signaling “to (re-)associate SCell with TA group.” EX1007, 2. Potevio discloses including in the RRC message a “TA group index’ concept, [in which] cells with the same TA value share the same TA group index.” EX1007 at 2.

213. Potevio’s principal discussion point is a “Need for [a] TA group index,” noting “Every cell should be associated to a TA group to apply TA value for uplink transmission. The relationship between configured cell and TA group should be configured by eNB, i.e. explicit signalling is necessary to establish mapping between each cell and a TA group. One simple approach is introducing the concept of TA group index and all cells share the same TA value are

configured with the same TA group index.” EX1007 at 1. A POSITA would have understood from the disclosure of Potevio and Dinan that the methods described in Potevio for configuring SCells would be performed through a processor in the UE.

214. A POSITA would have understood that, according to Petovio, the RRC processor of the UE would process the RRC message including the TA group index of each SCell being added, where “cells with [the] same TA value share the same TA group index,” EX1007, 2, to associate the one or more SCells being added with other available SCells associated with same TA group index “to (re)-associate SCell with TA group.” *Id.* A POSITA would have understood that “cells with [the] same TA value” form a TAG. EX1001, 1:54-58; EX1007, 1 (under the “‘TA group index’ concept, cells with the same TA value share the same TA group index”).

215. A POSITA would have been motivated by the teachings of Potevio to modify Dinan to associate the SCell(s) being added as an available SCell for use with the UE with another available SCell associated with the same TAG identifier and had a reasonable expectation of success. *See* Section X.B.1. Accordingly, the Dinan-Potevio combination discloses and renders obvious Element [1f].

(e) [1g] wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value

216. The Dinan-Potevio combination discloses and renders obvious Element [1g]. Dinan discloses and renders obvious associating the TAG with

SCells having timing based on a same timing advance (TA) value as recited in Element [1g]. See the discussion at Section X.A.1(h), incorporated herein. Furthermore, the combination of Dinan and Potevio discloses and renders obvious the TAG being associated with SCells having timing based on a same timing advance (TA) value as recited in Element [1g]. See Element [1f], Section X.B.2(d), above.

217. Element [1g] would have been well known to a POSITA at the time of the earliest possible priority date of the '776 patent, as recognized in its Background section. EX1001, 1:54–58 (A TAG is “a group of one or more serving cells having the same timing advance value” and was used in a multiple component carrier system “to effectively perform timing alignment.”). It would have been obvious in view of the knowledge of a POSITA to include in the disclosure of Dinan associating the TAG with SCells having timing based on the same timing advance (TA) value as recited in Element [1g]. *See* Elements [1c] and [1f], above, incorporated herein.

218. In addition, Potevio discloses the TAG is identified by a TA group index, and the TAG is associated with SCells having the same timing advance value. EX1007 at 1 (“Every cell should be associated to a TA group to apply TA value for uplink transmission. The relationship between configured cell and TA group should be configured by eNB, i.e. explicit signalling is necessary to establish

mapping between each cell and a TA group. One simple approach is introducing the concept of TA group index and all cells share the same TA value are configured with the same TA group index.”); *see also, id.* at 2 (“cells with the same TA value share the same TA group index”).

219. A POSITA would have been motivated by the teachings of Potevio to configure Dinan such that the TAG identified by the tag identifier is associated with SCells having timing based on the same timing advance (TA) value and had a reasonable expectation of success. *See* Section X.B.1. Accordingly, the Dinan-Potevio combination discloses and renders obvious Element [1g].

220. Thus, it would have been obvious to a POSITA to combine Dinan with Potevio to arrive at the purported invention recited in claim 1, and a POSITA would have had a reasonable expectation of success in doing so.

3. Dependent Claims 2-4

- (a) 2. The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG**
- (b) 3. The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message**
- (c) 4. The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an**

indication to remove an SCell from SCells available to the UE

221. Claims 2-4 would have been obvious to a POSITA in view of the combination of Dinan and Potevio. Dinan discloses and renders obvious dependent claims 2-4, as described above in Sections X.A.2-4, respectively.

4. Claims 5–8

222. The Dinan-Potevio combination renders claims 5-8 obvious for the same reasons as claims 1-4, respectively. See Sections X.B.2-3.

C. Ground 4: Claims 1-8 Would Have Been Obvious in View of Dinan and Sharp

223. In my opinion, claims 1-8 would have been obvious in view of Dinan and Sharp.

1. The Dinan-Sharp Combination

224. It would have been obvious to a POSITA prior to the earliest possible priority date of the '776 patent to combine Dinan and Sharp to arrive at the subject matter of claims 1-8. A POSITA would have been motivated to combine Dinan and Sharp because they are directed to the same technologies and a skilled artisan would have understood the benefits of combining these references. A POSITA would have understood that there was a high likelihood of success in making the combination.

225. Dinan and Sharp are readily combinable because they are directed to protocols for a radio interface between user equipment and base stations in LTE in systems using TA groups, and in particular about Timing Advance and Timing Advance Groups. Sharp discloses specific ways to handle TAGs and to associate an SCell and a TAG. EX1006, 1 (“In RAN2#76bis, RAN2 agreed that RRC signalling is used to (re-)associate SCell with a TA group.... In this contribution, we would like to discuss the way to handle TA group in a multi-TA scenario.”). It therefore would have been obvious to a POSITA to apply advantageous teachings of Sharp concerning how to handle signaling TA group configurations via the RRC to Dinan.

226. As recognized in the ’776 patent, the concept of a timing advance group was well-known at the time of the purported invention. EX1001, 1:54-58. A POSITA would have understood that there was a need for a mechanism to identify different TAGs, and that the simplest and most straightforward way to do so would be with a unique TAG identifier.

227. Furthermore, for example, Sesia explains that “the timing of the PCell and all SCells configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2) is therefore sufficient to control the UE’s uplink transmission timing for **all the uplink CCs** [Component Carriers] **together.**” EX1015 (Sesia) at 642 (emphasis added). In other words,

creating a Timing Advance Group (a TAG) was known to a POSITA at the time of the earliest priority date of the '776 patent as a POSITA understood at that time that a single TA command would have been used for the entire TAG. Sesia discloses a plurality of SCells having the same TA value, i.e., belonging to the same TAG. Thus, associating one or more SCells with another available SCell having the same TA, and by extension having the same TAG identifier, would have been obvious to a POSITA in view of the state of the art at the time of the earliest priority date of the '776 patent.

228. Sesia further explains that “Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” EX1015 at 642. It is common sense, and was well within a POSITA’s knowledge at the time of the earliest priority date of the '776 patent, that the presence of more than one timing advance group (e.g., the already existing TAG plus the new ones to be introduced in Release 11) would necessitate a mechanism to identify a given TAG.

229. A POSITA would have appreciated at the time of the earliest priority date of the '776 patent that the simplest, most straight-forward way to do so is to assign a unique identifier to a given TAG, e.g., TAG #1, TAG #2, etc. This approach was already being used at that time for purposes of identifying each SCell using the *SCellIndex*. See, e.g., TS36.331 at 210, as shown below.

— *SCellIndex*

The IE *SCellIndex* concerns a short identity, used to identify an SCell.

***SCellIndex* information element**

```
-- ASN1START
SCellIndex-r10 ::=                INTEGER (1..7)
-- ASN1STOP
```

EX1005 at 210

230. Using an index to identify a TAG is a simple extension of the same well-understood principle of using an index (*SCellIndex*) to identify a SCell. Thus, using a unique identifier to identify a specific TAG would have been readily appreciated by a POSITA as suitable for use to identify one of several TAGs each associated with one or more SCells, and a POSITA would have had a high expectation of success in so using a TAG identifier based on the successful use of the *SCellIndex* to identify unique SCells.

231. Further, the specification of the '776 patent expressly discloses the need for a “clearly defined” signaling protocol for informing that a secondary cell is included in a TAG, and for informing the UE when a TAG is changed according to a channel condition. EX1001, 1:66-2:5. Sharp discloses “the way to handle TA group in a multi-TA scenario” and proposes to use a TAG identifier (i.e., a TAG-ID) in that endeavor. EX1006, 1 (“[I]t is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the

sTAG to which the SCell will align the UL timing.... TA group and UL of SCell in sTAG are mapped by TAG-ID.”). Sharp further proposes that “TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.* Sharp also discloses that the radio resource control (RRC) is used to “(re-)associate SCell with a TA group.” *Id.*

232. A POSITA would have looked to such teachings in Sharp, including the use of a TAG identifier and radio resource control (RRC) messaging to associate the SCell being added with another available SCell associated with same TAG identifier. Based on Sharp’s teachings, it would have been obvious to a POSITA, and a POSITA would have been motivated, to use and configure Dinan with a TAG-ID which acts as an identifier of a timing advance group (TAG) associated with one or more SCells and to use and configure the RRC processor to associate each SCell with other available SCells associated with same TAG identifier where the TAG being associated with the SCells have timing based on the same timing advance (TA) value.

233. A skilled artisan would have combined Dinan and Sharp, and would have had a reasonable expectation of success in doing so as the concept of a Timing Advance Group (TAG) was known in the art and was acknowledged as such in the specification of the ’776 patent itself. EX1001, 1:54-58. Sharp discloses a specific suggestion as to how to modify a field of an RRC message to include the TAG-ID configuration. *See* EX1006, 3 (“TAG-ID configuration

should be included in UL configuration of *PhysicalConfigDedicatedSCell*.”). A POSITA would have understood that Sharp’s teachings to include TAG-ID configuration information is applicable to other fields including the *sCellToAddModList*, particularly since this field is used to add a cell in Dinan and Sharp teaches that “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.... TA group and UL of SCell in sTAG are mapped by TAG-ID.” EX1006, 1. A POSITA would have had a reasonable expectation of success in combining Sharp with Dinan in view of Sharp’s express guidance on how to fix the problem (associating SCells to a TAG). The combination of Dinan and Sharp is merely the predictable use of interchangeable prior art elements according to their established functions. This combination is not one of innovation but of ordinary skill and common sense.

234. Additionally, this combination of Dinan and Sharp would have yielded predictable results and required nothing more than routine engineering and common sense. Dinan teaches that RRC messages can be used in conjunction with using Timing Advance Groups. *See, e.g.*, EX1009 at [0030]-[0045]; EX1010 at 20-23, 78-79, 85-86, 92-94. Sharp teaches specific details about TA groups as shown by its title, “TA group handling,” disclosing specific implementations of the disclosed TAG-ID configuration techniques. EX1006. A POSITA would have

appreciated the use of an index was already successfully used to identify unique SCells, namely by using an SCellIndex, and would work similarly well to identify different TAGs. A POSITA would have only needed to modify an existing RRC message disclosed in the TS36.331 specification as proposed by Sharp. A POSITA would have found it obvious to modify the *sCellToAddModList* field disclosed in Dinan and the *PhysicalConfigDedicatedSCell* field disclosed in Sharp. A POSITA would have been capable of configuring the RRC with a TAG-ID as an identifier of a timing advance group (TAG) and to use it to associate SCells with the same timing advance (TA) value. A POSITA would have understood that this modification had a high likelihood of success and was obvious.

2. Independent Claim 1

235. Claim 1 would have been obvious to a POSITA in view of the combination of Dinan and Sharp.

- (a) [1pre] A user equipment (UE)**
 - [1a] a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex**
 - [1b] a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex**

236. Dinan discloses and renders obvious Elements [1pre]-[1b], as described above in Sections X.A.1.(a)-X.A.1(c).

**(b) [1c] an identifier of a timing advance group (TAG)
associated with the one or more SCell**

237. Dinan discloses and renders obvious an identifier of a timing advance group (TAG) associated with the one or more SCell as recited in Element [1c]. See the discussion at Section X.A.1(d), incorporated herein.

238. As Sesia [EX1015] explains, the concept of a timing advance group was known in the art. Specifically, Sesia explains that “the timing of the PCell and all SCells configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2) is therefore sufficient to control the UE’s uplink transmission timing for **all the uplink CCs** [Component Carriers] **together.**” EX1015 (Sesia) at 642 (emphasis added). In other words, as recognized in the ’776 patent, creating a Timing Advance Group (a TAG) was known to a POSITA at the time of the earliest priority date of the ’776 patent, and a POSITA understood at that time that a single TA command would have been used for the entire TAG. See EX1001, 1:54–65.

239. Sesia further explains that “Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” EX1015 at 642. It is common sense, and was well within a POSITA’s knowledge at the time of the earliest priority date of the ’776 patent, that the presence of more than one timing advance group (e.g., the already existing TAG discussed in the above paragraph plus the new ones to be introduced in Release 11) would necessitate a

mechanism to identify a given TAG. A POSITA would have readily appreciated at the time of the earliest priority date of the '776 patent that the simplest, most straight-forward way to do so is to assign a unique identifier to a given TAG, e.g., TAG #1, TAG #2, etc. This approach was already being used at that time for purposes of identifying each SCell using the *SCellIndex*. Using an index to identify a TAG is a simple extension of the same well-understood principle of using an index to identify a SCell. Thus, using a unique identifier to identify a specific TAG would have been readily appreciated by a POSITA as suitable for use to identify one of several TAGs each associated with one or more SCells.

240. Furthermore, Sharp discloses an identifier of a timing advance group (TAG) associated with the one or more SCell as recited in Element [1c]. Sharp acknowledges the known problem of “how to realize the association between SCell and TA group” when RRC signaling is used. EX1006 at 1. Sharp is specifically directed at “the way to handle TA group in a multi-TA scenario.” *Id.* Sharp notes that in Rel-11, “one or more TA groups can be configured with the SCells only (sTAG),” and thus “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.” *Id.* Sharp discloses that “TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.*

241. Sharp further discloses that “TAG-ID configuration should be included in UL configuration of *PhysicalConfigDedicatedSCell*.” EX1006, 3 (emphasis in the original). A POSITA would have understood that the *PhysicalConfigDedicatedSCell* is part of an RRC message. See e.g., EX1005, 58 (“if the received *radioResourceConfigDedicated* includes the *physicalConfigDedicated*: 2> reconfigure the physical channel configuration as specified in 5.3.10. 6”), 126-127 (“SCellAdd ... *radioResourceConfigDedicatedSCell-r10*”), 174 (*PhysicalConfigDedicated*), 184 (*RadioResourceConfigDedicated*).

242. Furthermore, a POSITA would have found it obvious to include the TAG-ID disclosed in Sharp in the *sCellToAddModList* field of Dinan such that the TAG-ID is in the same field used for adding a specific SCell. A POSITA would have recognized that the *sCellToAddModList* is one of a finite number of suitable RRC message structures for conveying the corresponding TAG-ID, and would have been an obvious variant to include when configuring the SCell when it was added. The Dinan provisional demonstrates that a POSITA would have known at the time of the earliest priority date of the '776 patent that the *sCellToAddModList* field was a suitable location for TAG configuration information. See, e.g., EX1010, 30-31 (“TAG configuration may be included in *sCellToAddModlist* and a TAG ID may be included in the TAG configuration. The TA group could be

configured when an SCell is added.”). In any case, a POSITA would have understood the options for the location of the TAG-ID disclosed in Sharp as either in the sCellToAddModList field, where the SCell was being added or modified, or in a different field. In view of the recognized need in the art for a TAG-ID and the limited location choices, a POSITA would have found it obvious to so arrange the TAG-ID, using only ordinary skill and common sense to pursue this option.

243. A POSITA would have been motivated in view of the teachings of Sharp and Dinan to include an identifier of a TAG (in the form of a TA group index) associated with the SCell(s) being added and had a reasonable expectation of success. *See* Section X.C.1. Accordingly, the Dinan-Sharp combination discloses and renders obvious Element [1c].

- (c) **[1d] a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and [1e] to add the one or more SCell as an available SCell for use with the UE and**

244. Dinan discloses and renders obvious Elements [1d]-[1e], as described above in Sections X.A.1.(e)-X.A.1(f).

- (d) **[1f] to associate the one or more SCell with another available SCell associated with same TAG identifier**

245. Dinan discloses and renders obvious associating the one or more SCell with another available SCell associated with same TAG identifier as recited in Element [1f]. See the discussion at Section X.A.1(g), incorporated herein.

246. In addition, Sharp also discloses Element [1f]. The discussion of Element [1c] above in Section X.C.2.(b) is incorporated herein.

247. Sharp discloses “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.” EX1006, 1. Sharp discloses that “TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.*

248. Sharp further discloses that “TAG-ID configuration should be included in UL configuration of *PhysicalConfigDedicatedSCell*.” EX1006, 3. A POSITA would have understood that the *PhysicalConfigDedicatedSCell* is part of an RRC message described in TS36.331. *See e.g.*, EX1005, 58 (“if the received *radioResourceConfigDedicated* includes the *physicalConfigDedicated*: 2> reconfigure the physical channel configuration as specified in 5.3.10. 6”), 126-127 (“SCellAdd ... *radioResourceConfigDedicatedSCell-r10*”), 174 (*PhysicalConfigDedicated*), 184 (*RadioResourceConfigDedicated*). A POSITA would have understood that the RRC processor of Dinan’s UE would process the RRC message including the *PhysicalConfigDedicatedSCell* (or the *sCellToAddModList* in an obvious variant) to associate the one or more SCells being added with each other SCell available to the UE that itself is associated with same TAG identifier “to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.” EX1006, 1.

249. A POSITA would have been motivated by the teachings of Sharp and Dinan to associate the SCell(s) being added as an available SCell for use with the UE with another available SCell associated with the same TAG identifier and had a reasonable expectation of success. *See* Section X.C.1. Accordingly, the Dinan-Sharp combination discloses and renders obvious Element [1f].

(e) [1g] wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value

250. The Dinan-Sharp combination discloses and renders obvious Element [1g]. Dinan discloses and renders obvious associating the TAG with SCells having timing based on a same timing advance (TA) value as recited in Element [1g]. *See* the discussion at Section X.A.1(h), incorporated herein. Furthermore, the combination of Dinan and Sharp discloses and renders obvious the TAG being associated with SCells having timing based on a same timing advance (TA) value as recited in Element [1g]. *See* Element [1f], Section X.C.2(d), above.

251. Element [1g] would have been well known to a POSITA at the time of the earliest possible priority date of the '776 patent, as recognized in its Background section. EX1001, 1:54–58 (A TAG is “a group of one or more serving cells having the same timing advance value” and was used in a multiple component carrier system “to effectively perform timing alignment.”). It would have been obvious in view of the knowledge of a POSITA to include in the disclosure of Dinan associating the TAG with SCells having timing based on the

same timing advance (TA) value as recited in Element [1g]. *See* Elements [1c] and [1f], above, incorporated herein.

252. In addition, Sharp discloses the TAG is associated with SCells having timing based on the same TA value. *See, e.g.*, EX1006, 1 (“[I]t is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align with UL timing... TA group and UL of SCell in sTAG are mapped by TAG-ID”). Furthermore, Sharp’s Figure 2 shows “up to 4 TA groups” each having the same value for the TA command. EX1006, 2.

253. A POSITA would have been motivated by the teachings of Sharp to configure Dinan such that the TAG identified by the TAG identifier is associated with SCells having timing based on the same timing advance (TA) value and had a reasonable expectation of success. *See* Section X.C.1. Accordingly, the Dinan-Sharp combination discloses and renders obvious Element [1g].

254. Thus, it would have been obvious to a POSITA to combine Dinan with Sharp to arrive at the purported invention recited in claim 1, and a POSITA would have had a reasonable expectation of success in doing so.

3. Dependent Claims 2-4

- (a) **2. The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a**

primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG

- (b) 3. The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message**
- (c) 4. The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE**

255. Claims 2-4 would have been obvious to a POSITA in view of the combination of Dinan and Sharp. Dinan discloses and renders obvious dependent claims 2-4, as described above in Sections X.A.2-4, respectively.

4. Claims 5–8

256. The Dinan-Sharp combination renders claims 5-8 obvious for the same reasons as claims 1-4, respectively. See Sections X.B.2-3.

D. Ground 5: Claims 1–8 Would Have Been Obvious in View of TS36.331 and Sharp

257. In my opinion, claims 1–8 of the '776 patent would have been obvious to a POSITA in view of the combination of TS36.331 and Sharp.

1. The TS36.331-Sharp Combination

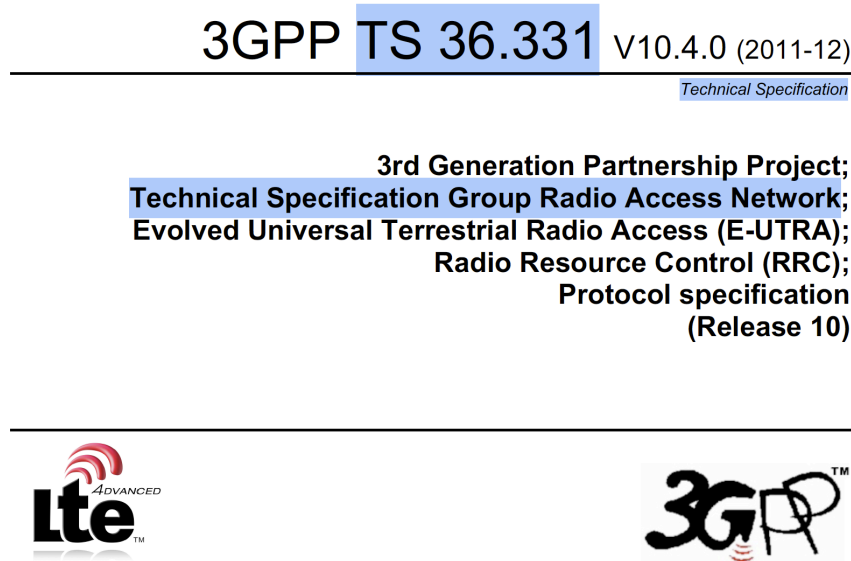
258. It would have been obvious to a POSITA prior to the earliest possible priority date of the '776 patent to combine TS36.331 and Sharp to arrive at the subject matter of claims 1–8. A POSITA would have been motivated to combine TS36.331 and Sharp because they are directed to the same technologies and a

skilled artisan would have understood the benefits of combining these references. A POSITA would have understood that there was a high likelihood of success in making the combination.

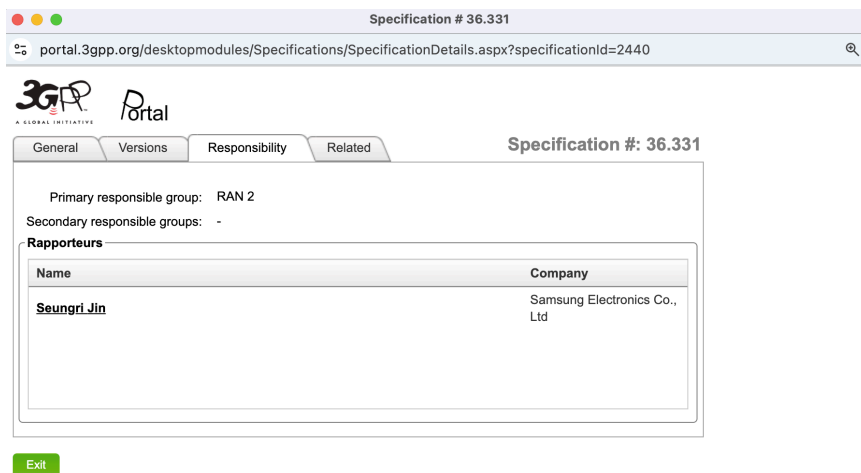
259. TS36.331 and Sharp are readily combinable because these references are directed to protocols for a radio interface between user equipment and base stations in LTE. Sharp is readily combinable with TS36.331 because both references are directed to wireless communication systems including base stations and UEs using SCells, and Sharp discloses specific ways to associate a SCell and a TAG. EX1006 at 1 (“In RAN2#76bis, RAN2 agreed that RRC signalling [*sic*, signaling] is used to (re-)associate SCell with a TA group.... In this contribution, we would like to discuss the way to handle TA group in a multi-TA scenario.”). It therefore would have been obvious to a POSITA to apply advantageous teachings of Sharp concerning how to handle signaling TA group configurations via the RRC to TS36.331’s specification.

260. Importantly, a POSITA would have found it obvious, and would have been motivated, to use and modify the TS36.331 specification following the TA group handling process described in Sharp since the very reason for the existence of this Technical Document (“TDoc”) is to provide updates to TS36.331, as I detail below.

261. As I discussed above in Section V.B, 3GPP is organized into TSGs (Technical Specification Groups) and each TSG is organized into a number of WGs (working groups). Specifically, as shown in the highlighted portion of the cover page of TS36.331 shown below, the TSG “Radio Access Network” (also referred to as “RAN”) is responsible for the Technical Specification TS36.331:



262. Furthermore, Sharp is a TDoc submitted in Meeting #77 of “TSG-RAN WG2” as is shown in the heading of Sharp. EX1006. This is important as one can see from the tab “Responsibility” of the TS36.331, as shown below:



263. In other words, the “Primary responsible group” for the continued development of TS36.331 is also “RAN 2”, i.e., working group #2 of the RAN TSG which published Sharp, a fact which a POSITA would have known. I also note that there is no “Secondary responsible group.”

264. In short, the very reason for the existence of Sharp is to incorporate its teachings into TS36.331. A POSITA would have known that the contents of Sharp were written by a group of peers to provide instructions for modifying the disclosure of TS36.331 in subsequent iterations of the specification, and therefore include “self-executing” reasons to combine that have been carefully scrutinized to confirm the suitability of modifying TS36.311 as proposed in the TDoc.

265. As recognized in the ’776 patent, the concept of a timing advance group was known in the art. EX1001, 1:54–58. Furthermore, for example, Sesia explains that “the timing of the PCell and all SCells configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2) is therefore sufficient to control the UE’s uplink transmission timing

for **all the uplink CCs** [Component Carriers] **together.**” EX1015 (Sesia) at 642 (emphasis added). In other words, creating a Timing Advance Group (a TAG) was known to a POSITA at the time of the earliest priority date of the ’776 patent as a POSITA understood at that time that a single TA command would have been used for the entire TAG. Sesia discloses a plurality of SCells having the same TA value, i.e., belonging to the same TAG. Thus, associating one or more SCells with another available SCell having the same TA, and by extension having the same TAG identifier, would have been obvious to a POSITA in view of the state of the art at the time of the earliest priority date of the ’776 patent.

266. Sesia further explains that “Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” EX1015 at 642. It is common sense, and was well within a POSITA’s knowledge at the time of the earliest priority date of the ’776 patent, that the presence of more than one timing advance group (e.g., the already existing TAG plus the new ones to be introduced in Release 11) would necessitate a mechanism to identify a given TAG.

267. A POSITA would have appreciated at the time of the earliest priority date of the ’776 patent that the simplest, most straight-forward way to do so is to assign a unique identifier to a given TAG, e.g., TAG #1, TAG #2, etc. This approach was already being used at that time for purposes of identifying each SCell using the *SCellIndex*. See, e.g., TS36.331 at 210, as shown below.

— *SCellIndex*

The IE *SCellIndex* concerns a short identity, used to identify an SCell.

***SCellIndex* information element**

```
-- ASN1START
SCellIndex-r10 ::=                INTEGER (1..7)
-- ASN1STOP
```

EX1005 at 210

268. Using an index to identify a TAG is a simple extension of the same well-understood principle of using an index (*SCellIndex*) to identify a SCell. Thus, using a unique identifier to identify a specific TAG would have been readily appreciated by a POSITA as suitable for use to identify one of several TAGs each associated with one or more SCells, and a POSITA would have had a high expectation of success in so using a TAG identifier based on the successful use of the *SCellIndex* to identify unique SCells.

269. Additionally, the specification of the '776 patent expressly notes that it was known in the art that there was a need for a “clearly defined” signaling protocol for informing that a secondary cell is included in a TAG, and for disclosure of a method for implementing the informing of a terminal when a TAG is changed according to a channel condition. EX1001, 1:66–2:5. Sharp discloses “the way to handle TA group in a multi-TA scenario” and proposes to use a TAG identifier (i.e., a TAG-ID) in that endeavor. EX1006 at 1 (“[I]t is necessary to

provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.”). Sharp further proposes that “ TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.* Sharp also discloses that the radio resource control (RRC) is used to “(re-)associate SCell with a TA group.” *Id.*

270. A POSITA would have looked to such teachings in Sharp to include the use of a TAG identifier and radio resource control (RRC) in the TS36.331 framework. Based on Sharp’s teachings, it would have been obvious to a POSITA, and a POSITA would have been motivated, to use and configure the TS36.331 system with a TAG-ID which acts as an identifier of a timing advance group (TAG) associated with one or more SCells and to use and configure the RRC processor to associate each SCell with other available SCells associated with same TAG identifier where the TAG being associated with the SCells have timing based on the same timing advance (TA) value.

271. A POSITA would have looked, prior to the earliest possible priority date of the ’776 patent, to such teachings in Sharp to modify TS36.331. As a result, a skilled artisan would have combined TS36.331 and Sharp and would have had a reasonable expectation of success in doing so as the concept of a Timing Advance Group (TAG) was known in the art and was acknowledged as such in the specification of the ’776 patent itself. EX1001, 1:54-58. Indeed, Sharp discloses a

specific suggestion as to how to modify a field of an RRC message to include the TAG-ID configuration. *See* EX1006 at 3 (“TAG-ID configuration should be included in UL configuration of *PhysicalConfigDedicatedSCell*.”). (emphasis in the original). A POSITA would have understood that Sharp’s teachings to include TAG-ID configuration information is applicable to other RRC messages including the *sCellToAddModList*, particularly since this field is used to add a cell in TS36.331 and Sharp teaches that “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.... TA group and UL of SCell in sTAG are mapped by TAG-ID.” EX1006, 1. A POSITA would have had a reasonable expectation of success in combining Sharp with TS36.331 in view of Sharp’s express guidance on how to fix the problem (associating SCells to a TAG).

272. Additionally, the combination of TS36.331 and Sharp would have yielded predictable results and required nothing more than routine engineering and common sense. TS36.331 teaches the structure of RRC messages and their use, while Sharp teaches specific details about TA groups as shown by its title, “TA group handling,” disclosing specific implementations of the disclosed TAG-ID configuration techniques. EX1006. Thus, a POSITA, in order to incorporate Sharp’s teachings into TS36.331’s Technical Specification, would have only needed to add the proposed changes from Sharp into the TS36.331 TS with respect

to the RRC. EX1006 at 3. TS36.331 teaches the structure of RRC messages and their use, and a POSITA would have only needed to configure the RRC to use a TAG-ID as an identifier of a timing advance group (TAG) and to associate an SCell with another available SCell associated with same TAG-ID, where the TAG being associated with two or more SCells have timing based on the same timing advance (TA) value. A POSITA would have appreciated the use of an index was already successfully used to identify unique SCells, namely by using an SCellIndex, and would work similarly well to identify different TAGs. A POSITA would have only needed to modify an existing RRC message disclosed in the TS36.331 specification as proposed by Sharp. A POSITA would have found it obvious to modify the *sCellToAddModList* field disclosed in TS36.331 based on Sharp's teachings concerning the *PhysicalConfigDedicatedSCell*. Configuring the RRC to use a TAG-ID as an identifier of a timing advance group (TAG) and to associate an SCell with another available SCell associated with same TA group index, where the TAG being associated with the SCells have timing based on the same timing advance (TA) value, was therefore well within the capabilities of a POSITA prior to the earliest possible priority date of the '776 patent. A POSITA would have understood that this modification was vetted by the "Primary responsible group" for the continued development of TS36.331, had a high likelihood of success, and was obvious.

273. A POSITA would have been capable of configuring the RRC with a TAG-ID as an identifier of a timing advance group (TAG) and to use it to associate SCells with the same timing advance (TA) value. A POSITA would have understood that this modification had a high likelihood of success and was obvious.

274. The combination of TS36.331 and Sharp is merely the predictable use of interchangeable prior art elements according to their established functions. This combination is not one of innovation but of ordinary skill and common sense. Accordingly, the combination of TS36.331 and Sharp renders claims 1–8 of the ’776 patent obvious.

2. Independent Claim 1

275. Claim 1 would have been obvious to a POSITA in view of the combination of TS36.331 and Sharp.

(a) [1pre] A user equipment (UE)

276. TS36.331 discloses a user equipment (UE) as recited in Element [1pre]. TS36.331 discloses “the Radio Resource Control protocol for the radio interface between [the user equipment (UE)] and [the Evolved Universal Terrestrial Radio Access Network (E-UTRAN)],” EX1005 at 14 (1 Scope), which is a radio interface designed to provide the radio access network component of LTE architecture including the UE and a base station. *See also id.* at 1 (Title)

(“Radio Resource Control (RRC); Protocol specification”), 19 (4.2.1 UE states and state transitions) (“A UE is in RRC_CONNECTED when an RRC connection has been established.”). TS36.331 consistently refers to “User Equipment” by the abbreviation “UE.” *See, e.g., id.* at 19 (3.2 Abbreviations). Accordingly, TS36.331 discloses Element [1pre].

(b) [1a] a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex and

277. TS36.331 discloses a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex as recited in Element [1a]. TS36.331 discloses the UE includes a receiver to receive RRC messages from the base station through the radio access network. *See, e.g.,* EX1005 at 23 (5.1.2 General requirements) (“The UE shall: 1> process the received messages in order of reception by RRC, i.e. the processing of a message shall be completed before starting the processing of a subsequent message.”). A POSITA would have understood that, for the UE to process “received messages,” it must have a receiver to receive the RRC messages. Furthermore, a POSITA would have understood at the time of the earliest possible priority date of the ’776 patent that a UE includes a receiver to receive RRC messages from a base station in the network.

278. TS36.331 discloses a “SCellIndex” that “concerns a short identity, used to identify an SCell.” EX1005 at 210. TS36.331 discloses that “SCell” is an abbreviation for secondary cell. EX1005 at 18. TS36.331 discloses that “For a UE in RRC_CONNECTED configured with [carrier aggregation (CA)] the term ‘serving cells’ is used to denote the set of one or more cells comprising of the primary cell and all secondary cells.” EX1005 at 17; *see also id.* at 19 (4.2.1 UE states and state transitions) (“A UE is in RRC_CONNECTED when [a Radio Resource Connection (RRC)] connection has been established.”).

279. TS36.331 describes a process for receiving from a base station an RRC message with a field (the “*sCellToReleaseList*”) including an *SCellIndex* to identify an associated SCell to be released. EX1005 at 46 (5.3.5.3 Reception of an *RRCCConnectionReconfiguration* ... by the UE) (“[T]he UE shall:... 1>if the received *RRCCConnectionReconfiguration* includes the *sCellToReleaseList*. 2>perform SCell release as specified in 5.3.10.3a.”), 60 (5.3.10.3a SCell release) (see below), 126-127 (*RRCCConnectionReconfiguration* message is a “command to modify an RRC connection” sent in the direction from base station to UE). TS36.331 discloses, for each *SCellIndex* value included in the *sCellToReleaseList*, the UE shall release the SCell with the *SCellIndex* value. *Id.* at 60 (5.3.10.3a SCell release) (see below).

5.3.10.3a SCell release

The UE shall:

- 1> if the release is triggered by reception of the *sCellToReleaseList*:
 - 2> for each *sCellIndex* value included in the *sCellToReleaseList*:
 - 3> if the current UE configuration includes an SCell with value *sCellIndex*:
 - 4> release the SCell;
 - 1> if the release is triggered by RRC connection re-establishment:
 - 2> release all SCells that are part of the current UE configuration;

EX1005 at 60.

280. The *sCellToReleaseList* can be included in an *RRCCConnectionReconfiguration* message, as shown below, specifically in the portions highlighted in blue:

– ***RRCConnectionReconfiguration***

The *RRCConnectionReconfiguration* message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCCH

Direction: E-UTRAN to UE

RRCConnectionReconfiguration message

```
-- ASN1START
RRCConnectionReconfiguration ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        c1                       CHOICE {
            rrcConnectionReconfiguration-r8      RRCConnectionReconfiguration-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture      SEQUENCE {}
    }
}

RRCConnectionReconfiguration-r8-IEs ::= SEQUENCE {
    measConfig          MeasConfig          OPTIONAL, -- Need ON
    mobilityControlInfo MobilityControlInfo  OPTIONAL, -- Cond HO
    dedicatedInfoNASList SEQUENCE (SIZE(1..maxDRB)) OF
        DedicatedInfoNAS          OPTIONAL, -- Cond nonHO
    radioResourceConfigDedicated RadioResourceConfigDedicated OPTIONAL, -- Cond HO-toEUTRA
    securityConfigHO      SecurityConfigHO  OPTIONAL, -- Cond HO
    nonCriticalExtension   RRCConnectionReconfiguration-v890-IEs OPTIONAL
}

RRCConnectionReconfiguration-v890-IEs ::= SEQUENCE {
    lateNonCriticalExtension OCTET STRING          OPTIONAL, -- Need OP
    nonCriticalExtension     RRCConnectionReconfiguration-v920-IEs OPTIONAL
}

RRCConnectionReconfiguration-v920-IEs ::= SEQUENCE {
    otherConfig-r9      OtherConfig-r9          OPTIONAL, -- Need ON
    fullConfig-r9       ENUMERATED {true}        OPTIONAL, -- Cond HO-
    Reestab             Reestab                  OPTIONAL,
    nonCriticalExtension RRCConnectionReconfiguration-v1020-IEs OPTIONAL
}

RRCConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
    sCellToReleaseList-r10 SCellToReleaseList-r10 OPTIONAL, -- Need ON
    sCellToAddModList-r10  SCellToAddModList-r10  OPTIONAL, -- Need ON
    nonCriticalExtension    SEQUENCE {}            OPTIONAL, -- Need OP
}

SCellToAddModList-r10 ::= SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellToAddMod-r10

SCellToAddMod-r10 ::= SEQUENCE {
    sCellIndex-r10      SCellIndex-r10,
    cellIdentification-r10 SEQUENCE {
        physCellId-r10
    }
}
```

```

        dl-CarrierFreq-r10                ARFCN-ValueEUTRA
    }
    radioResourceConfigCommonSCell-r10    RadioResourceConfigCommonSCell-r10  OPTIONAL,  -- Cond SCellAdd
SCellAdd
    radioResourceConfigDedicatedSCell-r10 RadioResourceConfigDedicatedSCell-r10  OPTIONAL,  --
Cond SCellAdd2
    ...
}

SCellToReleaseList-r10 ::=                SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellIndex-r10

SecurityConfigHO ::=                      SEQUENCE {
    handoverType                          CHOICE {
        intraLTE                          SEQUENCE {
            securityAlgorithmConfig        SecurityAlgorithmConfig  OPTIONAL,  -- Cond
fullConfig
            keyChangeIndicator              BOOLEAN,
            nextHopChainingCount            NextHopChainingCount
        },
        interRAT                          SEQUENCE {
            securityAlgorithmConfig        SecurityAlgorithmConfig,
            nas-SecurityParamToEUTRA       OCTET STRING (SIZE(6))
        }
    },
    ...
}

-- ASN1STOP

```

EX1005 at 126-127.

281. The portions highlighted in blue show that the *SCellToReleaseList* is part of the RRC connection reconfiguration message and it includes a *SCellIndex*, which is an index “used to identify an SCell” to be released. The structure of the *SCellIndex* is shown below:

– *SCellIndex*

The IE *SCellIndex* concerns a short identity, used to identify an SCell.

***SCellIndex* information element**

```

-- ASN1START
SCellIndex-r10 ::=                      INTEGER (1..7)
-- ASN1STOP

```

EX1005 at 210.

282. In other words, each of the one or more *SCellIndex*, having a value between 1 and 7, is used to “identify an SCell” in this case to be released. *See also* EX1005 at 23-24 (5.1.2 General requirements) (“The UE shall:...1>upon receiving a choice value set to *release*: 2> clear the corresponding configuration and stop using the associated resource.”).

283. The *sCellToReleaseList* field disclosed in TS36.331 is the same field that was later disclosed in the ’776 patent for performing the function of releasing SCells. *See, e.g.*, EX1001, 14:11-34 (“The secondary serving cell configuration information for releasing the secondary serving cell is *sCellToReleaseList*.”); 26:28-31 (“If the secondary serving cell configuration information includes a field ‘*sCellToReleaseList*’, the secondary serving cell configuration information is for releasing the secondary serving cell.”). A POSITA would have understood that TS36.331’s and the ’776 patent’s use of the same term “*sCellToReleaseList*” refers to the same field.

284. Accordingly, TS36.331 discloses and renders obvious Element [1a].

(c) **[1b] a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and**

285. TS36.331 discloses a second field comprising at least one *SCellIndex* to add one or more SCell associated with the at least one *SCellIndex* as recited in

Element [1b]. This is found in the portions of the specification shown above in the discussion of Element [1a] and highlighted in green. *See* EX1005, 126-127.

286. TS36.331 discloses a process for receiving from a base station an RRC message with a field (the “*sCellToAddModList*”), which includes an *SCellIndex* to identify at least one associated SCell to be added. EX1005 at 46 (5.3.5.3 Reception of an *RRCCONNECTIONRECONFIGURATION* ... by the UE) (“[T]he UE shall: ... 1> if the received *RRCCONNECTIONRECONFIGURATION* includes the *sCellToAddModList*. 2> perform SCell addition or modification as specified in 5.3.10.3b.”), 60 (5.3.10.3b SCell addition/modification) (see below).

5.3.10.3b SCell addition/ modification

The UE shall:

- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition):
 - 2> add the SCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*;
 - 2> configure lower layers to consider the SCell to be in deactivated state;
- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is part of the current UE configuration (SCell modification):
 - 2> modify the SCell configuration in accordance with the received *radioResourceConfigDedicatedSCell*;

EX1005 at 60.

287. TS36.331 discloses, for each *SCellIndex* value included in the *sCellToAddModList* not part of the current configuration, the UE shall add the SCell with such *SCellIndex* value. *Id.* at 60 (5.3.10.3b SCell addition/modification) (“The UE shall: 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell

addition): 2> add the SCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*.”); *see also id.* at 126-127 (*RRConnectionReconfiguration* message).

288. The “*SCellIndex*” is used in the same way as was used to release a SCell discussed above in connection with Element [1a], i.e., it “concerns a short identity, used to identify an SCell,” EX1005 at 210, but, in this case, each of the one or more *SCellIndex* is used to “identify an SCell” to be added.

289. A POSITA would have understood that TS36.331’s and the ’776 patent’s use of the term “sCellToAddModList” refers to the same field. *See* EX1001, 17:26-37 (the “sCellToAddModList” field “indicates the index of the secondary serving cell to be added ‘SCellIndex.’”); 26:31-35 (“[I]f the secondary serving cell configuration information includes a field ‘sCellToAddModList’, the secondary serving cell configuration information is for adding the secondary serving cell.”).

290. Accordingly, TS36.331 discloses and renders obvious Element [1b].

**(d) [1c] an identifier of a timing advance group (TAG)
associated with the one or more SCell**

291. TS36.331 renders Element [1c] obvious. It would have been obvious in view of the knowledge of a POSITA to include in the disclosure of 36.331 an

identifier of a timing advance group (TAG) associated with the one or more SCell as recited in Element [1c].

292. As Sesia [EX1015] explains, the concept of a timing advance group was known in the art. Specifically, Sesia explains that “the timing of the PCell and all SCells configured for a UE is expected to be synchronized. A single Timing Advance (TA) command (see Section 18.2) is therefore sufficient to control the UE’s uplink transmission timing for **all the uplink CCs** [Component Carriers] **together.**” EX1015 (Sesia) at 642 (emphasis added). In other words, as recognized in the ’776 patent, creating a Timing Advance Group (a TAG) was known to a POSITA at the time of the earliest priority date of the ’776 patent, and a POSITA understood at that time that a single TA command would have been used for the entire TAG. See EX1001, 1:54–65.

293. Sesia further explains that “Release 11 will introduce the possibility of independent TA per CC, which may be beneficial for some scenarios.” EX1015 at 642. It is common sense, and was well within a POSITA’s knowledge at the time of the earliest priority date of the ’776 patent, that the presence of more than one timing advance group (e.g., the already existing TAG discussed in the above paragraph plus the new ones to be introduced in Release 11) would necessitate a mechanism to identify a given TAG. A POSITA would have readily appreciated at the time of the earliest priority date of the ’776 patent that the simplest, most

straight-forward way to do so is to assign a unique identifier to a given TAG, e.g., TAG #1, TAG #2, etc. This approach was already being used at that time for purposes of identifying each SCell using the *SCellIndex* discussed in Elements [1a] and [1b] above. Using an index to identify a TAG is a simple extension of the same well-understood principle of using an index to identify a SCell. Thus, using a unique identifier to identify a specific TAG would have been readily appreciated by a POSITA as suitable for use to identify one of several TAGs each associated with one or more SCells.

294. Furthermore, the TS36.311-Sharp combination discloses and renders obvious an identifier of a timing advance group (TAG) associated with the one or more SCell as recited in Element [1c]. Sharp acknowledges the known problem of “how to realize the association between SCell and TA group” when RRC signaling is used. EX1006 at 1. Sharp is specifically directed at “the way to handle TA group in a multi-TA scenario.” *Id.* Sharp notes that in Rel-11, “one or more TA groups can be configured with the SCells only (sTAG),” and thus “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.” *Id.* Sharp discloses that “TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.*

295. Sharp further discloses that “TAG-ID configuration should be included in UL configuration of *PhysicalConfigDedicatedSCell*.” EX1006, 3

(emphasis in the original). A POSITA would have understood that the *PhysicalConfigDedicatedSCell* is included in an RRC message. See e.g., EX1005, 58 (“if the received *radioResourceConfigDedicated* includes the *physicalConfigDedicated*: 2> reconfigure the physical channel configuration as specified in 5.3.10. 6”), 126-127 (“SCellAdd ... *radioResourceConfigDedicatedSCell-r10*”), 174 (*PhysicalConfigDedicated*), 184 (*RadioResourceConfigDedicated*).

296. Furthermore, a POSITA would have found it obvious to include the TAG-ID disclosed in Sharp to the *sCellToAddModList* field of TS36.331 such that the TAG-ID is in the field adding the SCell. As discussed above, a POSITA would have recognized that the *sCellToAddModList* is one of a finite number of suitable RRC message structures for conveying the corresponding TAG-ID. The Dinan provisional demonstrates that a POSITA would have known at the time of the earliest priority date of the '776 patent that the *sCellToAddModList* field was a suitable location for TAG configuration information. See, e.g., EX1010, 30-31 (“TAG configuration may be included in *sCellToAddModlist* and a TAG ID may be included in the TAG configuration. The TA group could be configured when an SCell is added.”). In any case, a POSITA would have understood the options for the location of the TAG-ID disclosed in Sharp as either in the *sCellToAddModList* field, where the SCell was being added or modified, or in a different field. In view

of the recognized need in the art for a TAG-ID and the limited location choices, a POSITA would have found it obvious to so arrange the TAG-ID, using only ordinary skill and common sense to pursue this option.

297. A POSITA would have been motivated by the teachings of Sharp to modify TS36.311 to include an identifier of a TAG (in the form of a TAG-ID) associated with the field identifying the SCell being added and had a reasonable expectation of success. *See* Section X.D.1. Accordingly, the combination of TS36.311 and Sharp discloses and renders obvious Element [1c].

(e) [1d] a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and

298. TS36.331 discloses a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex as recited in Element [1d]. TS36.331 discloses the UE includes a radio resource control (RRC) processor to process RRC messages received by the UE. TS36.331 discloses in its very first “General Requirement” that the UE processes messages. EX1005 at 23 (5.1.2 General requirements) (“The UE shall: 1> process the received messages in order of reception by RRC, i.e. the processing of a message shall be completed before starting the processing of a subsequent message.”). A POSITA would have understood from the disclosure of TS36.331 that the protocols described for releasing SCells would be performed through a processor in the UE. A POSITA

would have understood that, for the UE to process “received messages,” it must have a RRC processor to process the RRC messages. Furthermore, a POSITA would have understood at the time of the earliest possible priority date of the ’776 patent that a UE includes a processor to process RRC messages received from the network.

299. TS36.331 discloses “the Radio Resource protocol for the radio interface between UE and E-UTRAN as well as for the radio interface between RN and E-UTRAN.” EX1005 at 14. Included in the protocol are methods to release a SCell that is associated with an *SCellIndex*. For example, TS36.331 describes a process for “SCell release” whereby the UE releases SCells associated with *SCellIndex* values that are identified in a *sCellToReleaseList*. EX1005 at 60 (“The UE shall: if the release is triggered by reception of the *sCellToReleaseList*:... for each *sCellIndex* value included in the *sCellToReleaseList*: if the current UE configuration includes an SCell with value *sCellIndex*:... release the SCell”). TS36.331 describes a process for releasing the SCell corresponding to the *SCellIndex* in the *sCellToReleaseList* field. EX1005 at 46 (5.3.5.3 Reception of an *RRCCONNECTIONRECONFIGURATION* ... by the UE) (“[T]he UE shall:... 1>if the received *RRCCONNECTIONRECONFIGURATION* includes the *sCellToReleaseList*. 2>perform SCell release as specified in 5.3.10.3a.”), 60 (5.3.10.3a SCell release) (see below). TS36.331 discloses, for each *SCellIndex* value included in the

SCellToReleaseList, the UE shall release the SCell with the *SCellIndex* value. *Id.* at 60 (5.3.10.3a SCell release) (see below). A POSITA would have understood that the UE includes an RRC processor that operates to release the SCell associated with the *SCellIndex* value in the *SCellToReleaseList*.

5.3.10.3a SCell release

The UE shall:

- 1> if the release is triggered by reception of the *sCellToReleaseList*:
 - 2> for each *sCellIndex* value included in the *sCellToReleaseList*:
 - 3> if the current UE configuration includes an SCell with value *sCellIndex*:
 - 4> release the SCell;
 - 1> if the release is triggered by RRC connection re-establishment:
 - 2> release all SCells that are part of the current UE configuration;

EX1005 at 60.

300. TS36.331 discloses that the *sCellToReleaseList* is included in a “*RRCConnectionReconfiguration*” message that is a “command to modify an RRC connection” sent to the UE and which conveys information for “measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.” EX1005 at 126. Further details can be found in the discussion of Element [1a] above, Section X.D.2.(b), which is incorporated herein.

301. Accordingly, TS36.331 discloses and renders obvious Element [1d].

**(f) [1e] to add the one or more SCell as an available SCell
for use with the UE and**

302. TS36.331 discloses adding the one or more SCell as an available SCell for use with the UE as recited in Element [1e]. TS36.331 discloses a RRC processor as discussed above in Element [1d], which is incorporated herein. A POSITA would have understood from the disclosure of TS36.331 that the protocols described for adding SCells would be performed through a processor in the UE.

303. TS36.331 discloses “the Radio Resource protocol for the radio interface between UE and E-UTRAN as well as for the radio interface between RN and E-UTRAN.” EX1005 at 14. Included in the protocol are methods to add a SCell as an available SCell for use with the UE. For example, TS36.331 describes a process for “SCell addition / modification” whereby the UE adds SCells associated with *SCellIndex* values that are identified on a *sCellToAddModList*. EX1005 at 46 (5.3.5.3 Reception of an *RRCCConnectionReconfiguration* ... by the UE) (“[T]he UE shall:... 1>if the received *RRCCConnectionReconfiguration* includes the *sCellToAddModList*. 2> perform SCell addition or modification as specified in 5.3.10.3b.”), 60 (5.3.10.3b SCell addition/modification) (see below).

5.3.10.3b SCell addition/ modification

The UE shall:

- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition):
 - 2> add the SCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*;
 - 2> configure lower layers to consider the SCell to be in deactivated state;
- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is part of the current UE configuration (SCell modification):
 - 2> modify the SCell configuration in accordance with the received *radioResourceConfigDedicatedSCell*;

EX1005 at 60

304. TS36.331 discloses, for each *SCellIndex* value included in the *sCellToAddModList* that is not part of the current configuration, the UE shall add the SCell with such *SCellIndex* value. *Id.* at 60 (5.3.10.3b SCell addition/modification) (“The UE shall: 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition): 2> add the SCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*.”); *see also id.* at 126-127 (*RRConnectionReconfiguration* message). In this case, the one or more *SCellIndex* is used to “identify an SCell” to be added. A POSITA would have understood that the protocols TS36.331 described for adding SCells would be performed by a processor in the UE.

305. TS36.331 discloses that the *sCellToAddModList* is included in a “*RRCConnectionReconfiguration*” message that is a “command to modify an RRC connection” sent to the UE and which conveys information for “measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.” EX1005 at 126-127. Further details can be found in the discussion of Element [1b], which is incorporated herein.

306. Accordingly, TS36.331 discloses and renders obvious Element [1e].

(g) [1f] to associate the one or more SCell with another available SCell associated with same TAG identifier

307. The TS36.311-Sharp combination discloses and renders obvious associating the one or more SCell with another available SCell associated with same TAG identifier as recited in Element [1f]. As I explained above in the context of Element [1c], which discussion is incorporated herein, Sharp acknowledges the known problem of “how to realize the association between SCell and TA group” when RRC signaling is used. EX1006 at 1. Sharp is specifically directed at “the way to handle TA group in a multi-TA scenario.” *Id.* Sharp notes that in Rel-11, “one or more TA groups can be configured with the SCells only (sTAG),” and thus “it is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will

align the UL timing.” *Id.* Sharp discloses that “TA group and UL of SCell in sTAG are mapped by TAG-ID.” *Id.*

308. Sharp further discloses that “TAG-ID configuration should be included in UL configuration of *PhysicalConfigDedicatedSCell*.” EX1006 at 3 (emphasis in the original). A POSITA would have understood that the *PhysicalConfigDedicatedSCell* is a part of an RRC message. *See e.g.*, EX1005 at 58 (“if the received *radioResourceConfigDedicated* includes the *physicalConfigDedicated*: 2> reconfigure the physical channel configuration as specified in 5.3.10. 6”), 126-127 (“SCellAdd ... *radioResourceConfigDedicatedSCell-r10*”), 174 (*PhysicalConfigDedicated*), 184 (*RadioResourceConfigDedicated*). A POSITA would have understood that the RRC processor of the UE would process the RRC message including the *PhysicalConfigDedicatedSCell* (or the *sCellToAddModList* in an obvious variant) to associate the one or more SCells being added with other available SCells associated with same TAG identifier “to create an association between the SCell(s) and the sTAG to which the SCell will align the UL timing.” EX1006 at 1.

309. TS36.331 discloses in its very first “General Requirement” that the UE processes messages. EX1005 at 23 (“The UE shall: 1> process the received messages in order of reception by RRC, i.e. the processing of a message shall be completed before starting the processing of a subsequent message.”). A POSITA

would have understood from the disclosure of TS36.331 that the logical organization of interacting with and using SCells would be performed through a processor in the UE, and, therefore, the methods described in Sharp for associating SCells with TAGs would be performed through that UE processor.

310. A POSITA would have been motivated by the teachings of Sharp to modify TS36.311 to associate the SCell(s) being added with each other available SCell associated with the same TAG identifier and had a reasonable expectation of success. *See* Section X.D.1. Accordingly, the combination of TS36.311 and Sharp discloses and renders obvious Element [1f].

(h) [1g] wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value

311. The combination of TS36.331 and Sharp discloses and renders obvious the TAG being associated with SCells having timing based on the same timing advance (TA) value as recited in Element [1g]. *See* Element [1f], above in Section X.D.2.(g).

312. Element [1g] would have been well known to a POSITA at the time of the earliest possible priority date of the '776 patent, as recognized in its Background section. EX1001, 1:54–58 (A TAG is “a group of one or more serving cells having the same timing advance value” and was used in a multiple component carrier system “to effectively perform timing alignment.”). It would have been understood, and obvious, in view of the knowledge of a POSITA that the TAG is

associated with SCells having timing based on a same timing advance (TA) value as recited in Element [1g]. *See* Elements [1c] and [1f], above, Section X.D.2.(c), (g), incorporated herein.

313. In addition, Sharp teaches that a TAG is associated with SCells having timing based on the same TA value. *See, e.g.*, EX1006 at 1 (“[I]t is necessary to provide some kind of identifier (i.e. TAG-ID) to create an association between the SCell(s) and the sTAG to which the SCell will align with UL timing... TA group and UL of SCell in sTAG are mapped by TAG-ID”). This is also discussed by Sharp which explains that “it is possible to indicate up to 4 TA groups by 2 reserved bits in TA command.” EX1006 at 2. Thus Sharp discloses that up to 4 TAG can be used and each TAG has the same value for the TA, as conveyed by the Timing Advance Command shown in the Figure. EX1006 at 2.

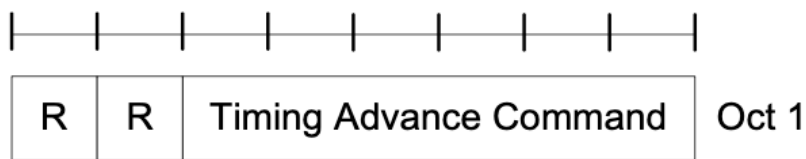


Fig.2: TA command MAC Control Element [4]

EX1006 at 2

314. A POSITA would have been motivated by the teachings of Sharp to modify TS36.311 such that the TAG identified by the TAG-ID is associated with SCells having timing based on a same timing advance (TA) value and had a

reasonable expectation of success. *See* Section X.A.1. Accordingly, the TS36.331-Sharp combination discloses and renders obvious Element [1g].

315. Thus, it would have been obvious to a POSITA to combine TS36.331 with Sharp to arrive at the purported invention recited in claim 1, and a POSITA would have had a reasonable expectation of success in doing so.

3. Dependent Claim 2

- (a) The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG**

316. The TS36.331-Sharp combination discloses and renders obvious the added limitation of Claim 2 that the UE processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG. Sharp discloses “when the UE in Rel-11 is configured with a SCell that is not explicitly assigned a TAG-ID, the UE considers that the SCell belongs to pTAG, and the UE can consider the TAG-ID of pTAG to be assigned a default value of ‘0.’” EX1006, 1. Sharp explains that this feature can help provide backward compatibility: “we prefer that the pTAG in a Rel-11 UE not be assigned such [a TAG] identifier to preserve backward compatibility (e.g. a Rel-11 UE that performs carrier aggregation without the multi-TA configuration, can adhere to the Rel-10 specification).” Potevio also explains that adopting a default value such as is described in Sharp can save

signaling overhead. EX1007, 1 (“[A]dopting default TA group index can save signalling overload. Hence we recommend that default value 0 be always allocated to PCell TA group, which is similar to *ServCellIndex* in Rel-10”).

317. A POSITA would have been motivated to modify TS36.331 with the teachings of Sharp such that the RRC processor associates an SCell with a TAG associated with a PCell when the second field to add an SCell does not comprise a TAG identifier in order to provide backward compatibility and to save overhead, and had a reasonable expectation of success. *See* Section X.D.1. Accordingly, the TS36.331-Sharp combination renders obvious Claim 2.

4. Dependent Claim 3

(a) The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message

318. TS36.331 discloses “the receiver receives the first and second field through a RRC connection reconfiguration message,” as recited in dependent claim 3. TS36.331 discloses the UE’s receiver receives RRC messages from the base station through the radio access network. *See, e.g.*, EX1005 at 23 (5.1.2 General requirements) (“The UE shall: 1> process the received messages in order of reception by RRC, i.e. the processing of a message shall be completed before starting the processing of a subsequent message.”), 126-127.

319. As explained above in connection with claim 1, TS36.331 discloses that the *sCellToReleaseList* and *sCellToAddModList* fields are both included in a “*RRCConnectionReconfiguration*” message that is a “command to modify an RRC connection” sent from the base station to the UE and which conveys information for “measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.” EX1005 at 126-127 at 126. The *sCellToReleaseList* field contains a serving cell index associated with a SCell to be released, (*id.* at 127), and the *sCellToAddModList* field contains a *SCellIndex* associated with a SCell to be added. *Id.* at 126-7; see discussion of Elements [1a] and [1b], Sections X.D.2(b), (c), incorporated herein.

– *RRCConnectionReconfiguration*

The *RRCConnectionReconfiguration* message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: E-UTRAN to UE

RRCConnectionReconfiguration message

```
-- ASN1START
RRCConnectionReconfiguration ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        c1                       CHOICE {
            rrcConnectionReconfiguration-r8      RRCConnectionReconfiguration-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture      SEQUENCE {}
    }
}

RRCConnectionReconfiguration-r8-IEs ::= SEQUENCE {
    measConfig                MeasConfig                OPTIONAL, -- Need ON
    mobilityControlInfo        MobilityControlInfo        OPTIONAL, -- Cond HO
    dedicatedInfoNASList       SEQUENCE (SIZE(1..maxDRB)) OF DedicatedInfoNAS OPTIONAL, -- Cond nonHO
    radioResourceConfigDedicated RadioResourceConfigDedicated OPTIONAL, -- Cond HO-toEUTRA
    securityConfigHO           SecurityConfigHO           OPTIONAL, -- Cond HO
    nonCriticalExtension        RRCConnectionReconfiguration-v890-IEs OPTIONAL
}

RRCConnectionReconfiguration-v890-IEs ::= SEQUENCE {
    lateNonCriticalExtension    OCTET STRING              OPTIONAL, -- Need OP
    nonCriticalExtension        RRCConnectionReconfiguration-v920-IEs OPTIONAL
}

RRCConnectionReconfiguration-v920-IEs ::= SEQUENCE {
    otherConfig-r9             OtherConfig-r9             OPTIONAL, -- Need ON
    fullConfig-r9              ENUMERATED {true}          OPTIONAL, -- Cond HO-
    Reestab                    Reestab                    OPTIONAL,
    nonCriticalExtension        RRCConnectionReconfiguration-v1020-IEs OPTIONAL
}

RRCConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
    sCellToReleaseList-r10     SCellToReleaseList-r10     OPTIONAL, -- Need ON
    sCellToAddModList-r10      SCellToAddModList-r10      OPTIONAL, -- Need ON
    nonCriticalExtension        SEQUENCE {}                OPTIONAL -- Need OP
}

SCellToAddModList-r10 ::= SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellToAddMod-r10

SCellToAddMod-r10 ::= SEQUENCE {
    sCellIndex-r10             SCellIndex-r10,
    cellIdentification-r10      SEQUENCE {
        physCellId-r10
    }
}
```

```

        dl-CarrierFreq-r10          ARFCN-ValueEUTRA
    }
    radioResourceConfigCommonSCell-r10  RadioResourceConfigCommonSCell-r10  OPTIONAL, -- Cond SCellAdd
SCellAdd
    radioResourceConfigDedicatedSCell-r10  RadioResourceConfigDedicatedSCell-r10  OPTIONAL, --
Cond SCellAdd2
    ...
}
SCellToReleaseList-r10 ::=          SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellIndex-r10
SecurityConfigHO ::=          SEQUENCE {
    handoverType          CHOICE {
        intraLTE
            securityAlgorithmConfig          SEQUENCE {
                SecurityAlgorithmConfig          OPTIONAL, -- Cond
fullConfig
                keyChangeIndicator          BOOLEAN,
                nextHopChainingCount          NextHopChainingCount
            },
        interRAT
            securityAlgorithmConfig          SEQUENCE {
                SecurityAlgorithmConfig,
                nas-SecurityParamToEUTRA          OCTET STRING (SIZE(6))
            }
    },
    ...
}
-- ASN1STOP

```

EX1005 at 126-27.

320. More generally, TS36.331 discloses a system in which, “For an SCell, E-UTRAN provides, via dedicated signalling, all system information relevant for operation in RRC_CONNECTED when adding the SCell. Upon change of the relevant system information of a configured SCell, E-UTRAN releases and subsequently adds the concerned SCell, which may be done with a single *RRCConnectionReconfiguration* message.” EX1005 at 24 (5.2 System information) (5.2.1 Introduction) (5.2.1 General), 126-127 (see below).

RRConnectionReconfiguration message

```
-- ASN1START
RRConnectionReconfiguration ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        c1                       CHOICE {
            rrcConnectionReconfiguration-r8      RRCConnectionReconfiguration-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture      SEQUENCE {}
    }
}

RRConnectionReconfiguration-r8-IEs ::= SEQUENCE {
    measConfig                MeasConfig                OPTIONAL,    -- Need ON
    mobilityControlInfo        MobilityControlInfo        OPTIONAL,    -- Cond HO
    dedicatedInfoNASList       SEQUENCE (SIZE (1..maxDRB)) OF
        DedicatedInfoNAS      OPTIONAL,    -- Cond nonHO
    radioResourceConfigDedicated RadioResourceConfigDedicated OPTIONAL, -- Cond HO-toEUTRA
    securityConfigHO           SecurityConfigHO          OPTIONAL,    -- Cond HO
    nonCriticalExtension        RRCConnectionReconfiguration-v890-IEs OPTIONAL
}

RRConnectionReconfiguration-v890-IEs ::= SEQUENCE {
    lateNonCriticalExtension    OCTET STRING              OPTIONAL,    -- Need OP
    nonCriticalExtension        RRCConnectionReconfiguration-v920-IEs OPTIONAL
}

RRConnectionReconfiguration-v920-IEs ::= SEQUENCE {
    otherConfig-r9              OtherConfig-r9            OPTIONAL,    -- Need ON
    fullConfig-r9               ENUMERATED {true}          OPTIONAL,    -- Cond HO-
    Reestab                     RRCConnectionReconfiguration-v1020-IEs OPTIONAL
}

RRConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
    sCellToReleaseList-r10      SCellToReleaseList-r10    OPTIONAL,    -- Need ON
    sCellToAddModList-r10       SCellToAddModList-r10     OPTIONAL,    -- Need ON
    nonCriticalExtension         SEQUENCE {}                OPTIONAL,    -- Need OP
}

SCellToAddModList-r10 ::= SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellToAddMod-r10
    dl-CarrierFreq-r10          ARFCN-ValueEUTRA
    radioResourceConfigCommonSCell-r10 RadioResourceConfigCommonSCell-r10 OPTIONAL, -- Cond SCellAdd
    SCellAdd
    radioResourceConfigDedicatedSCell-r10 RadioResourceConfigDedicatedSCell-r10 OPTIONAL, --
    Cond SCellAdd2
    ...
}

SCellToReleaseList-r10 ::= SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellIndex-r10

SecurityConfigHO ::= SEQUENCE {
    handoverType              CHOICE {
        intraLTE              SEQUENCE {
            securityAlgorithmConfig SecurityAlgorithmConfig OPTIONAL, -- Cond
            fullConfig
            keyChangeIndicator      BOOLEAN,
            nextHopChainingCount    NextHopChainingCount
        },
        interRAT              SEQUENCE {
            securityAlgorithmConfig SecurityAlgorithmConfig,
            nas-SecurityParamToEUTRA OCTET STRING (SIZE(6))
        }
    },
    ...
}

-- ASN1STOP
```

EX1005 at 126-127.

321. Accordingly, the TS36.331-Sharp combination renders obvious Claim 3.

5. Dependent Claim 4

(a) The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE

322. TS36.331 discloses and renders obvious “the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE,” as recited in dependent claim 4. See discussion of Element [1a], which is incorporated herein.

323. TS36.331 discloses “the Radio Resource protocol for the radio interface between UE and E-UTRAN as well as for the radio interface between RN and E-UTRAN.” EX1005 at 14. Included in the protocol are methods to release a SCell that is associated with an *SCellIndex*. For example, TS36.331 describes a process for “SCell release” whereby the UE releases SCells associated with *SCellIndex* values that are identified in a *sCellToReleaseList*. EX1005 at 60.

5.3.10.3a SCell release

The UE shall:

- 1> if the release is triggered by reception of the *sCellToReleaseList*:
 - 2> for each *sCellIndex* value included in the *sCellToReleaseList*:
 - 3> if the current UE configuration includes an SCell with value *sCellIndex*:
 - 4> release the SCell;
 - 1> if the release is triggered by RRC connection re-establishment:
 - 2> release all SCells that are part of the current UE configuration;

EX1005 at 60.

324. TS36.331 discloses a UE's receiver receiving from a base station an RRC message ("*RRCConnectionReconfiguration*") with a field ("*sCellToReleaseList*") including an *SCellIndex* to identify an associated SCell to be released. EX1005 at 46 (5.3.5.3 Reception of an *RRCConnectionReconfiguration* ... by the UE) ("[T]he UE shall:... 1>if the received *RRCConnectionReconfiguration* includes the *sCellToReleaseList*. 2> perform SCell release as specified in 5.3.10.3a."), 60 (5.3.10.3a SCell release), 126-127 (*RRCConnectionReconfiguration* message is a "command to modify an RRC connection" sent in the direction from base station to UE). TS36.331 discloses, for each *SCellIndex* value included in the *sCellToReleaseList*, the UE shall release the SCell with the *SCellIndex* value. *Id.* at 60 (5.3.10.3a SCell release) ("The UE shall: if the release is triggered by reception of the *sCellToReleaseList*:... for each *sCellIndex* value included in the

sCellToReleaseList: if the current UE configuration includes an SCell with value *sCellIndex*:... release the SCell”).

325. TS36.331 discloses that the *sCellToReleaseList* is included in a “*RRCConnectionReconfiguration*” message that is a “command to modify an RRC connection” sent from the base station to the UE and which conveys information for “measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information and security configuration.” EX1005 at 126.

326. Furthermore, removing a sCell from sCells available to the UE was well known to a POSITA before the claimed priority of the ’776 patent. For example, Sesia explains in certain cases the “RRC can add, **remove**, or reconfigure sCells for the target PCell” See EX1015 at 625 (emphasis added). A POSITA would have understood that releasing a cell identified in the *sCellReleaseList* renders that cell unavailable to the UE, as claimed. *See also* EX1005 at 23-24 (5.1.2 General requirements) (“The UE shall:...1>upon receiving a choice value set to *release*: 2> clear the corresponding configuration and stop using the associated resource.”).

327. Accordingly, claim 4 would have been obvious to a POSITA in view of the combination of TS36.331 and Sharp.

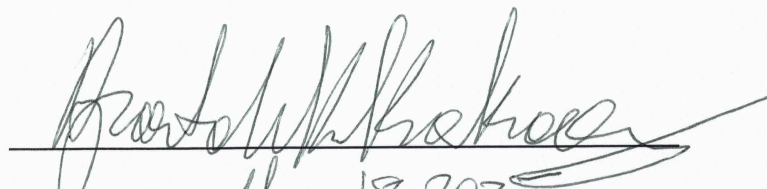
6. Claims 5-8

328. The TS36.331-Sharp combination renders claims 5-8 obvious for the same reasons as claims 1-4, respectively. See Sections X.D.2-5.

XI. ACKNOWLEDGMENTS

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

330. I declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.


Executed on May 18, 2025

Appendix A

APOSTOLOS K. KAKAES
Cosmos Communications Consulting Corporation, President
908 Park St. SE, Suite 201
Vienna, Virginia 22180
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AREAS OF EXPERTISE

All aspects of fixed and mobile communications. Over the years, my emphasis has been both in breadth and in depth, originally in fixed communications networks and then in mobile communications. Specific areas of in-depth expertise include:

- NR/5G, LTE/LTE-Advanced and evolution issues of 3G to 4G and 5G
- UMTS, including FDD, TDD, HSDPA/HSUPA, HSPA+, both air interface (UTRA) and Radio Access Network (RAN) as well as Core Network (CN) technologies
- GSM, GPRS, EDGE (EGPRS) and related evolutionary problems and solutions
- cdma2000 family from IS-95, through its evolution to 1x, 3x, 1xEV-DO (HDR), 1xEV-DV (all aspects of the evolution to “3G” and beyond)
- Wired and Wireless Local Area Networks (LAN) including all variants of IEEE 802.11 (WiFi)
- Metropolitan Area Networks (MAN), and Personal Area Networks (PAN) technologies, Paging networks, Ad hoc networks, including IEEE 802.16 (WiMAX), HIPERLAN, Bluetooth, Near Field Communications, IrDA (Infrared Data Association) operating with any of the available access technologies
- North American TDMA and IS-54/IS-136
- IMS, SIP, and VoIP (Voice over IP), including VoIP over LTE
- TETRA
- iDEN™
- Core Network technologies, IS-41, SS7, ATM, MAP, SAE, etc.
- Design and implementation of voice and data networking (circuit switching as well as all the evolving all IP-based technologies)
- Traffic engineering and network design; both air interface aspects (including resource allocation, QoS, MAC protocol, etc.) and design of core network, both user plane and control plane

EMPLOYMENT HISTORY

9/88 – Present

Cosmos Communications Consulting Corporation. Founder and president of private communications engineering consulting firm specializing in mobile communications. Initially part time; full time since 1994.

- Developed and presented courses, seminars, and lectures on fixed and mobile communications to both corporate and government entities, such as the FCC and the US Marshal’s Office.
- Consulted on high level technology-related issues and trends, pros and cons of each, etc. to corporate entities, governmental agencies, and international organizations, such as the UN.

- Consulted at the detailed technical level to engineering firms, operators, and equipment vendors on technical issues related to existing or evolving technologies for mobile communications.
- Served as technology consultant to the investment community on issues related to both fixed and wireless communications technologies.
- Served as consultant and/or testifying expert witness on both civil and criminal legal cases, including a class action lawsuit brought in California, a murder case in Illinois, and several patent infringement cases both at the ITC and in US district courts as well as in the High Court in the UK.
- Served as consultant and/or testifying expert witness on several Inter-Parte Re-examinations (IPRs).
- Served as consultant and testifying witness in Arbitrations involving mobile communications.
- Served as consultant and/or testifying expert witness in multiple legal proceedings involving the determination of "FRAND" rates for global licenses involving "SEP" patents.
- Participated as a technical consultant in the analysis of large patent portfolios for the purposes of due diligence, sales, and/or M/A activities for some of the largest companies in the mobile communications space.

Many of the above projects spanned a multidimensional spectrum of

- Technologies: both fixed and mobile communications as they have evolved over the past 30+ years;
- Audiences: non-technical support personnel, highly specialized engineers, Wall Street analysts, hedge fund managers, litigation teams, as well as decision making executives at the CEO/CFO/CTO level;
- Geographic and cultural backgrounds that span all continents and over 40 countries.

9/87 - 5/94

The George Washington University, Washington, D.C.; Department of Electrical Engineering and Computer Science.

- Taught mostly graduate courses in the area of communication engineering, including communication theory, coding theory, voice and data networking, and mobile communications.
- Proposed, developed and taught new graduate courses in the area of mobile communications.
- Received several research awards/grants, including the prestigious NSF Research Initiation Award.
- Participated in several committees, including the departmental Graduate Curriculum Committee as well as various University-wide committees.

7/85 - 12/86

Polytechnic Institute of New York, Brooklyn, New York. Joint appointment as Special Research Fellow and Adjunct Instructor (while pursuing the Ph.D. degree).

1/82 - 7/87

AT&T Bell Laboratories, Holmdel, New Jersey. Worked on modeling, analysis, design, and performance evaluation of voice and data networks. Developed algorithms for DNHR (Dynamic, Non-Hierarchical Routing) used in the telephone network. Analysis of advanced data services and formulation of long term plans for development of enhanced data services and network design tools to support such services.

7/76 - 12/81

University of Colorado, Boulder, Colorado and Michigan State University, East Lansing, Michigan. Undergraduate and then graduate teaching assistant.

EDUCATION

09/82 - 01/88

Polytechnic Institute of New York. Ph.D. in Electrical Engineering with a minor in Applied Mathematics.

Thesis Title: Topological Properties and Design of Multihop Packet Radio Networks.

Thesis Advisor: Professor Robert R. Boorstyn.

09/74 - 06/80

University of Colorado.

M.S. in Applied Mathematics with a minor in Electrical Engineering.

B.S. in Applied Mathematics with a minor in Electrical Engineering.

PROFESSIONAL ASSOCIATIONS AND ACTIVITIES

- Member of the IEEE (Active in the Communications Society, Vehicular Technology Society, and the Information Theory Society).
- Secretary, IEEE Communications Society National Capital Area Chapter, 91/92.
- Vice-Chair, IEEE Communications Society National Capital Area Chapter, 92/93.
- Vice-Chair of the Communication Theory Technical Committee of the Communications Society of the IEEE; Elected for the 1993-1996 term.
- Treasurer of the Communication Theory Technical Committee of the Communications Society of the IEEE, Elected for the 1996-1999 term.
- Reviewer for the IEEE, book editors, and other technical publications.
- Reviewer for various NSF Panels.
- Active Participant and Organizer of Technical Sessions in Technical Conferences, including the IEEE International Conference on Communications (ICC) and IEEE Global Communications Conference (Globecom).
- Technical Program Chair for the Communication Theory Mini-Conference, Dec. 1992.

PUBLICATIONS AND PRESENTATIONS

1. "Topological Properties and Design of Multi-Hop Packet Radio Networks"; Presented at the IEEE Information Theory Society Meeting; Arlington, Virginia; February 1988.
2. "Topology and Capacity of Multi-Hop Packet Radio Networks" (Joint with R.R. Boorstyn); 1988 International Symposium on Information Theory; Kobe, Japan; June 1988.
3. "Placing Repeaters in Multi-Hop Packet Radio Networks" (Joint with R.R. Boorstyn); *Proceeding of Globecom '89*, Dallas, Texas; November 1989.
4. "Topological Properties and Design of Packet Radio Networks"; Invited Presentation at the National Technical University of Athens; Athens, Greece; January 10, 1990.
5. "Channel Allocation Strategies in Dual Mode Digital Cellular Networks"; *Proceedings of Globecom '90*, San Diego, California; December 1990.
6. "Bandwidth Allocation Techniques in Dual Mode Cellular Systems"; Invited Presentation at the Rutgers University Wireless Information Networks Laboratory (WINLAB); January 25, 1991.
7. "Some Topological Properties of Different Classes of Random Graphs with Applications to Communication Networks", *Proceedings of the IEEE Information Theory Symposium*, Budapest, Hungary; June 1991.
8. "The Effects of Residual Bandwidth in TDMA Cellular Networks", IEEE Communication Theory Workshop, Rhodes, Greece, July 1991.
9. "Concentrators and Concentrator Design", *Encyclopedia of Telecommunications*, Fritz E. Froehlich, Editor-in-chief; Marcel Dekker, Inc, 1992.
10. "Comparison of TDMA and CDMA for Cellular Networks," Ecole Nationale Supérieure des Telecommunications, Paris, France, March 5, 1992.
11. "Dual Mode Digital Cellular Networks: The Effects of Bandwidth Segmentation on Digital and Analog Users," Presented at the IEEE Communications Society Meeting, April 16, 1992.
12. "Dynamic Channel Allocation and Reallocation for Dual-System Cellular Networks, *Workshop Record*, (with Sirin Tekinay and Bijan Jabbari), Third Winlab Workshop on Third Generation Wireless Information Networks, Piscataway, NJ, April 28-29, 1992.
13. "Spread Spectrum Technology Applications in Telecommunications," Tutorial presented at the 1992 IEEE Mohawk Valley Section Conference, June 1992.
14. "Spread Spectrum Fundamentals: Techniques and Applications", Tutorial (in cooperation with Giovanni Vannucci) presented at ICC'92, June 1992.
15. "Global System for Mobile Communications (GSM)", Presented at ICC'93, Geneva, Switzerland, May 25, 1993.
16. "Data Communications Basics", *Encyclopedia of Software Engineering*, John Wiley & Sons, Inc., 1993.
17. "Modelling of Cellular Communication Networks with Heterogeneous Traffic Sources" (with Sirin Tekinay and Bijan Jabbari), *Proceedings of the International Conference on Universal Personal Communications, 1993*, October 1993.
18. "Global System for Mobile Communications (GSM)", Presented at the Francusko-Polska Wysza Szkola, Poznan, Poland, March 1994.

19. "Traffic Engineering for Cellular Network Design", Presented at the Francusko-Polska Wysza Szkola, Poznan, Poland, March 1994.
20. "Principles of Traffic Engineering and Network Design", Presented at the Regional Seminar on Mobile Cellular Radio Telephone Systems, by invitation of the ITU, April 19, 1994.
21. "Principles of Spread Spectrum Systems for Mobile Communications", Presented at the Regional Seminar on Mobile Cellular Radio Telephone Systems, by invitation of the ITU, April 20, 1994.
22. "Global System for Mobile Communications (GSM)", Presented at the Regional Seminar on Mobile Cellular Radio Telephone Systems, by invitation of the ITU, April 21, 1994.
23. "Global System for Mobile Communications (GSM)", Presented at ICC'94, New Orleans, LA.; May 1, 1994.
24. "GSM and DCS1900: Evolution to PCS", ICC/Supercom 1996, Dallas, Texas; June 23-27, 1996.
25. "Traffic Engineering Models for Mobile Communications", ICUPC96, Cambridge, Massachusetts; Sept. 29 - October 2, 1996.
26. "GSM-Recent Advances and Future Developments", Globecom'96, London, UK; November 1996.
27. "Advances in GSM and DCS1800/1900", ICC '97, Montreal, Canada; June 1997.
28. "The Global System for Mobile Communications (GSM) and its Derivatives (DCS1800, PCS1900)", ICC/Supercom '98, Atlanta, GA; June 1998.
29. "Teletraffic Engineering", Globecom '98, Sydney, Australia; November 1998.
30. "Traffic Engineering" in Encyclopedia of Telecommunications; Edited by John Proakis, John Wiley, 2002.