UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

INNOVATIVE SONIC LIMITED AND CELERITY IP, LLC.
Patent Owner.

Case IPR2024-00991
U.S. Patent No. 9,736,883

DECLARATON OF MARK MAHON, PH.D IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,736,883

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I, Mark Mahon, Ph.D., declare as follows.

I. INTRODUCTION

1. I have been retained by Petitioners AT&T Services, Inc., T-Mobile USA, Inc., Cellco Partnership d/b/a Verizon Wireless, Ericsson Inc., and Nokia of America Corporation as an independent expert consultant in this proceeding before the United States patent and Trademark Office ("PTO") against Innovative Sonic Ltd. ("Patent Owner") regarding U.S. patent No. 9,736,883 ("the '883 patent") (Ex-1001). I have been asked to consider whether certain references disclose or suggest the features recited in claims 1–11 ("the Challenged Claims") of the '883 patent. My opinions are set forth below.

2. I am being compensated at a rate of $550 per hour for my work in this proceeding plus reimbursement of direct expenses. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

3. My educational background, career history, publications, and other relevant qualifications provided here are only a summary. My full curriculum vitae is attached to this declaration as Exhibit 1004.

4. Based on my education, research, and work experience, I am knowledgeable about the subject matter of the ’883 patent and the related prior art.

5. I am a Teaching Professor in the School of Electrical Engineering and Computer Science at Pennsylvania State University, University Park, PA (“Penn State” or “PSU”). I have worked on telecommunications networks, including AMPS, IS-95, CDMA2000, GSM, EDGE, UMTS/WCDMA, LTE, and 5G cellular systems since 1988.

6. I received my B.S. in Electronics Engineering from the University of Scranton in 1987. I received my M.S. in Electrical Engineering and Ph.D. in Acoustics from Penn State in 1991 and 2001, respectively.

7. In 1988, after I received my bachelor’s degree, I joined the Central Intelligence Agency (CIA) while pursuing my M.S. degree at Penn State part-time. My first job at the CIA involved designing and testing systems to automatically capture and characterize telecommunication signals and emissions from various computer networking devices.

8. I returned to Penn State in early 1990 to pursue graduate research full-time and complete my M.S. degree. My graduate research work focused on wideband beamforming and adaptive signal processing. After completing my M.S. degree in EE in 1991, I accepted a full-time faculty research position at the Applied Research Lab at PSU, primarily working on classified programs, and began working

on diverse radio frequency and acoustic sensor systems including wireless communications and small wireless networks for acoustic tracking, source localization, and feature extraction.

9. I began pursuing my Ph.D. part-time in 1993 while continuing my faculty research position. In 1997, as part of my faculty research position, I began working on classified programs focused on mathematical analytical modeling of cellular communication networks and the development of hardware and software systems to test against cellular networks. My role was to develop the algorithms and write the code running on a specially developed embedded system. For this work, I received a letter of recognition as the "genius behind the VELA software algorithms" from the Director of National Reconnaissance Office (NRO) Systems Engineering and Technology Office. As part of this same work, I was extensively involved in protocol and signaling analysis as well as researching model-specific performance and unique functional characteristics associated with individual mobile devices. The work involved testing dozens of handsets from many manufacturers in controlled and real-world environments against network simulators and live operational networks for each research project.

10. In 2000 my research extended into utilizing non-orthogonal wavelets for improving detection and localization of cellular handsets from high altitude sensor systems. In 2001, I completed my Ph.D. and my research focused on the

utilization of advanced communication signals for wideband characterization and remote sensing of propagation channels.

11. Beginning in 1997 my cellular communications research work focused on CDMA, GSM, EDGE, UMTS, LTE, and 5G cellular systems primarily under grants sponsored primarily by the Department of Defense. This classified research work required 3GPP protocol analysis and development of real-time embedded hardware and software systems capable of interacting with cellular networks and cellular handsets. A large portion of my work was directed at architectures, protocols, software, and signaling.

12. I have been working on classified projects since 1988. Before 1998, because the work was not deemed highly classified, I was able to publish eight journal and conference papers prior to 2000. Between 1999 and 2015, however, I was allowed to publish only one article in an unclassified symposium and published and presented about a dozen articles in classified settings. This is because during this period, the vast majority of my research was highly classified. As a result, nearly all of my research results were summarized in classified reports and not available to the general public. Further, because the U.S. government owns any intellectual property resulting from the sponsored research work, I did not pursue or file patent applications.

13. In 2015, I transferred to the School of Electrical Engineering and Computer Science at Penn State as a teaching faculty member. In that role, I have continued teaching graduate and undergraduate courses, guiding Ph.D. and M.S. students in communication and mobile networking (including LTE and 5G cellular networks), and pursuing research in this and related areas. Since 2015, I have been an author on nine refereed papers as listed in my curriculum vitae (CV) (attached as Exhibit 1004).

14. Because of my decades of research and my continuing work at Penn State, I have intimate knowledge of telecommunication networks, including the technology involved in the patent here. I have been highly recognized as an expert in such systems within the research community. I was recognized twice by the National Reconnaissance Office with commendation letters for work dealing with detecting cellular signals in low signal to noise ratio environments. The U.S. government awarded me over $12M in grants between 2003 and 2015 for projects focused on mobile communication devices and networks, in which I served as a Principal Investigator (PI), Co- PI, and/or technical lead.

15. Additionally, during my research career, I interacted extensively with computer scientists and engineers responsible for the design, development, and testing of telephony and data networking systems and testbeds. As a research faculty member, I oversaw engineers and computer scientists that executed many joint

projects with development organizations. These interactions exposed me to a wide range of computer scientists and engineers working on telecommunication network technologies. Since 2011, I have been teaching undergraduate and graduate classes in communication and mobile networking and am familiar with the curricula being taught to electrical engineers and computer scientists. The interactions with a wide range of computer scientists and engineers working on telecommunication network technologies and the familiarity with the classes taught to electrical engineers and computer scientists have allowed me to have a good understanding of the level of skills possessed by a person of ordinary skill in the field of cellular technology.

16. I have extensive experience with mobile networks in general and LTE and 5G specifically. While most of my research efforts between 1998 and 2015 are highly classified, I can state that they included detailed investigation of network architectures, signaling, and functional behavior. A typical research effort would involve studying 3GPP, 3GPP2, IEEE, and other protocol standards to fully comprehend all aspects of L1, L2, and L3 requirements including timing, bit-level construction of the control and user plane messages, and timing characteristics for a given standard as well as functional behavior of network components and user equipment.

17. From 2006 through 2015 my research focused specifically on LTE. My research continues to this day, although I am no longer operating in a classified

environment. During this time, I investigated the performance and functional differences of many varied network and handset devices to see how differing signaling and environmental factors influenced the behavior of user equipment in a given network environment. This included how synchronization, timing, and signal to interference plus noise ratio (SINR) for a given device would affect specific functional aspects including elements of the receiver structure, decoding and demodulation performance, calculation of parameters used by the device for making decisions and deriving parameters reported to the network.

18. As part of my research work, I built several custom LTE platforms that implemented specific network-side and user equipment-side functionality including custom signal generation and processing structures, particularly the signal processing chains on both the transmit and receive sides. This equipment was developed using network simulation hardware in a laboratory environment and was later tested with LTE networks in both controlled and fully operational environments. Implementing the transmit and receive chains for custom built LTE-enabled equipment required me to gain an intimate understanding of the relevant 3GPP protocol specifications and the underlying OFDM and WCDMA structures. Since 2015, I have been primarily focused on guiding graduate students pursuing research into network tasking and resource allocation, multiple-input multiple-output (MIMO) techniques to improve throughput in dense-user environments,

optimized distributed processing algorithms, and the implementation of block chain coding techniques to improve handover security in 4G (LTE)/5G (NR) networks.

III. MATERIALS REVIEWED

19. The opinions contained in this declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding signal processing, communications, and coding.

20. In forming my opinions expressed in this declaration, I reviewed the following materials and information:

Ex. Number	Title
1001	U.S. Patent No. 9,736,883 to Guo et al. ("the '883 patent")
1002	File History of U.S. patent No. 9,736,883
1005	U.S. Patent No. 9,479,973 ("Centonza")
1006	U.S. Provisional patent Application No. 61/678,722 ("Centonza Provisional")
1007	WIPO Publication No. WO2014056130A1 ("Han")
1008	RWS-120046, "Technologies for Rel-12 and onwards" ("The Samsung Presentation")
1009	3GPP TS 36.331 V11.2.0 (2012-12)
1010	3GPP TS 36.413 V11.0.0 (2012-06)
1011	U.S. patent Pub. No. 2013/0303224 ("Sambhwani")
1012	U.S. patent Pub. No. 2013/0183970 ("Chen")
1013	U.S. patent Pub. No. 2014/0010207 ("Horn")

21. I also reviewed any other materials I refer to in this declaration in support of my opinions.

22. My opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also

been guided by my understanding of how a person of ordinary skill in the art would have understood the state of the art, the prior art, and the claims and the specification of the ’883 patent at the time of the alleged invention.

23. I understand that Patent Owner has asserted that the priority date of the ’883 patent is at least as early as January 30, 2013, which I understand is the filing date of Provisional Application No. 61/758,418. I understand that it is Patent Owner’s burden to prove that the Challenged Claims are entitled to that January 30, 2013 date and, absent such proof, the Challenged Claims are entitled to the filing date on the face of the ’883 patent (which is January 29, 2014). Given that I am unaware of Patent Owner proving priority to an earlier filing date, it is assumed that the operative priority date is January 29, 2014. I have assumed, however, that the time of the alleged invention of the ’883 patent is around January 30, 2013, based on Patent Owner’s assertion. My opinions in this matter are the same whether the date of the alleged invention is January 30, 2013, January 29, 2014, or a date in between.

24. My opinions reflect how one of ordinary skill in the art (which I describe below) would have understood the ’883 patent, the prior art to the patent, and the state of the art at the times of the alleged invention as I was asked to consider, noted above.

25. Based on my experience and expertise, it is my opinion that the prior art discloses and/or suggests all the features recited the Challenged Claims of the ’883 patent, as I discuss in detail below.

IV. PERSON OF ORDINARY SKILL IN THE ART

26. Based on my knowledge and experience, I understand what a person of ordinary skill in the art would have known at the times of the alleged invention. My opinions herein are, where appropriate, based on my understandings as to a person of ordinary skill in the art at those times.

27. In my opinion, based on the materials and information I have reviewed, and based on my experience in the technical areas relevant to the ’883 patent, as of the earliest claimed priority date, a person of ordinary skill in the art at the time of the alleged invention of the ’883 patent (“POSITA”), which for purposes of this proceeding I have assumed is around January 30, 2013, would have had a B.S. in Electrical Engineering or a related field with at least three years of experience designing, developing, and/or testing telecommunication systems. A POSITA would also have familiarity with the wireless standards and well-known protocols for accessing wireless networks. More education may supplement practical experience or *vice versa*. I apply this understanding in my analysis herein.

28. All of my opinions in this declaration are from the perspective of one of ordinary skill in the art, during the relevant timeframe, which I discussed above

as being around January 30, 2013 to January 29, 2014. During this timeframe, I possessed at least the qualifications of a person of ordinary skill in the art, as defined above.

V. THE '883 PATENT

A. Background on Dual Connectivity in Cellular Systems

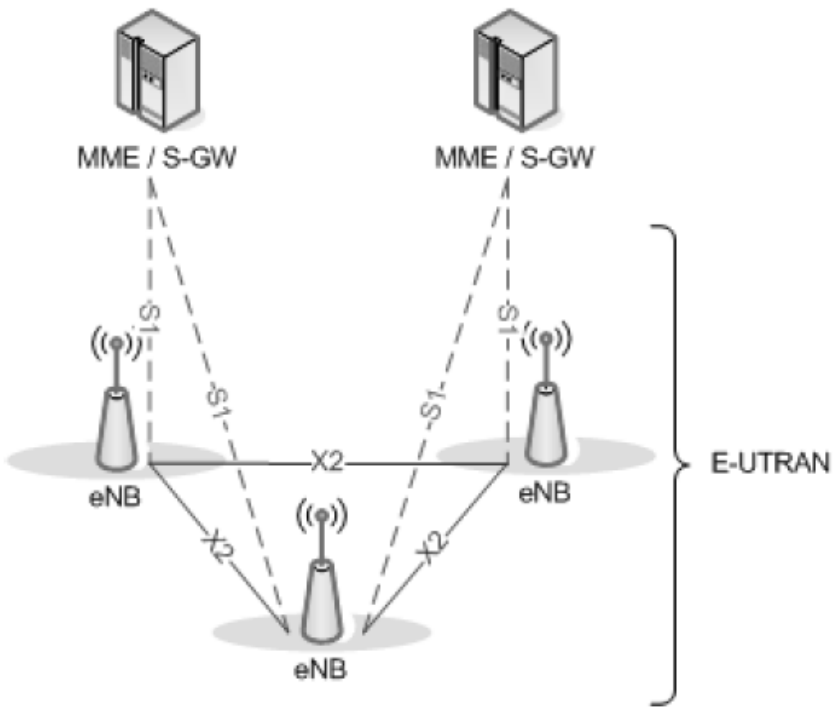
29. The technology of the '883 patent relates to "inter-node connectivity."[1] The patent discusses this functionality in cellular systems and cites to a number Long-Term Evolution standards and related documents (also known as "LTE" or "4G") that existed at that time.[2] These systems, as the patent describes, use a network structure called E-UTRAN, which is an acronym for Evolved Universal Terrestrial Radio Access Network.[3] This architecture includes base stations (referred to as "eNBs") and a core network that contains devices like a Mobility Management Entity (or "MME") and a Serving Gateway (or "SGW").[4]

[1] *See, e.g.*, Ex-1001, (54).

[2] *See, e.g.*, Ex-1001 at 2:47–64 (incorporating by reference version 11.2 of the 3GPP TS 36.331 standard); *Id.*, 1:33–42, 2:48–64 (describing E-UTRAN).

[3] *See, e.g.*, Ex-1001, 1:33–42, 2:48–64.

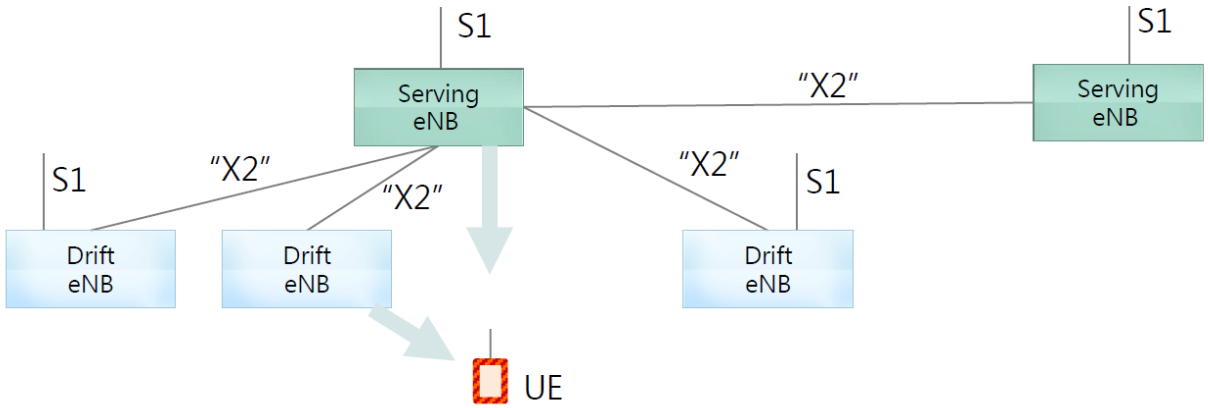
[4] *See e.g.*, Ex-1008, 19; Ex-1006, 9 (Fig. 1); Ex-1005, Fig. 2.



30. The eNBs can communicate over an "X2" interface, and each eNB can communicate through the core network devices (*e.g.*, the MME and SGW) over an "S1" interface. The eNBs provide the service to a User Equipment (or "UE"), such as a smartphone. The S1 and X2 interfaces are standard interfaces for E-UTRAN systems, like those in LTE (or 4G) networks, which predate the '883 patent.

31. In general, "inter-node connectivity" refers to the ability of multiple eNBs to serve a UE. This functionality, which is sometime called "dual connectivity" when there are two nodes (or eNBs) involved, also predates the '883 patent. The patent incorporates as prior art a Samsung presentation (3GPP RWS-

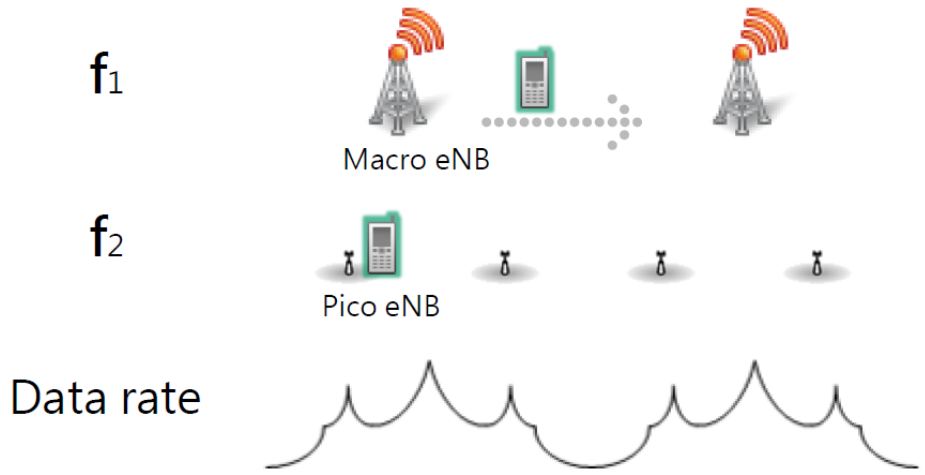
120046) that shows dual connectivity using a Serving eNB (in green) and a Drift eNB (in blue).[5]



32. As the UE moves out of range of a Serving eNB, the Drift eNBs boost the data throughput, as shown below with "Macro eNBs" (the Serving eNBs) and "Pico eNBs" (the Drift eNBs).[6]

[5] *See, e.g.*, Ex-1008, 20; Ex-1001, Fig. 5.

[6] *See, e.g.*, Ex-1008, 20.



33. The UE is associated with "cells" that are controlled by the eNBs, *e.g.*, a primary cell and a secondary cell. The image above shows macro cells (f_1) controlled by the Macro eNBs and pico cells controlled by the Pico eNBs. The macro cells form a macro cell layer and the pico cells form a pico cell layer.

34. Through inter-node connectivity, the UE can communicate data using both a macro cell and a pico cell. As the patent acknowledges, and reflected in the Samsung presentation, methods to provide dual connectivity in cellular systems existed prior to the '883 patent. For example, both Centonza and Han disclose handling dual connectivity for use in LTE-based systems.[7]

[7] *See, e.g.*, Ex-1005, 10:38–39 ("We define this case as 'multiple connectivity' or dual connectivity.'"); Ex-1007, [0003] ("[T]he concept of 'dual connection' has

B. Overview of the Patent

35. The ’883 patent provides, per its title, a technique for “handling inter-node connectivity in a wireless communication system.”[8] It discloses an example technique to handle inter-node connectivity. The eNB that controls a Primary Cell (or “PCell”) of a UE transmits a “to the eNB that cell(s) which could be aggregated.”[9] The eNB that receives the message would then accept the request in response.[10] These steps are generally shown in steps 620 and 625 in Figure 6 below.

36. The eNB would then send a request “switch a data path or to change a splitting rule (such as for a radio bearer, a service, or a logical channel).”[11] The patent explains that this request could be sent to the eNB directly or through “a core

recently emerged as a way to incorporate LAs [Local Areas] into cellular networks.”).

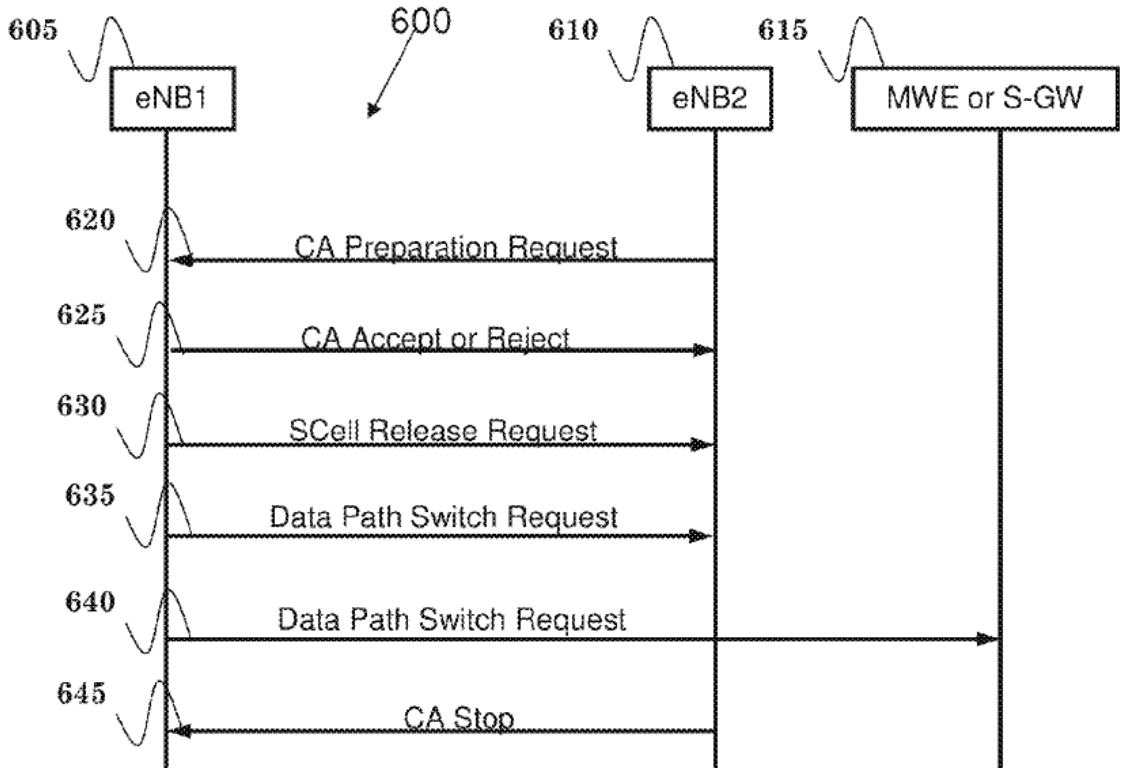
[8] *See, e.g.*, Ex-1001, (54).

[9] *See, e.g.*, Ex-1001, 7:5–27.

[10] *See, e.g.*, Ex-1001, 7:5–27.

[11] *See, e.g.*, Ex-1001, 7:5–27.

network node (such as a MME or a S-GW)," as shown as two options in Figure 6 (at steps 635 and 640).[12]



37. The '883 patent explains that, "[i]n one embodiment, as shown in step 635 of FIG. 6, a first network node could transmit a request to a second network node to change a data path corresponding to a first type of transmission and/or reception of a UE (User Equipment) from a first path to a different path (such as a

[12] *See, e.g.*, Ex-1001, 7:5–27.

second path)."[13] "In another embodiment, as shown in step 640 of FIG. 6, the first network node could transmit a request to a core network node (such as a MME or a S-GW) to change a data path corresponding to a first type of transmission and/or reception of the UE from a first path to a different path (such as a second path)."[14] The '883 patent recites these two paths as two interchangeable approaches to switching the data path and does not explain either in detail or characterize them as particularly inventive aspects of the claims.

38. Claim 1 of the '883 patent, reproduced below, shows the main steps of the claimed technique.[15]

A method for handling inter-node connectivity in a wireless communication system, comprising:

> receiving, by a first evolved node B (eNB), a first request from a second eNB for aggregating a Secondary Cell (SCell) for a User Equipment (UE);
>
> transmitting an accept message from the first eNB to the second eNB in response to the first request; and
>
> transmitting a second request from the first eNB, which controls the SCell of the UE, to the second eNB, which controls a Primary Cell (PCell) of

[13] *See, e.g.*, Ex-1001, 8:23–33.

[14] *See, e.g.*, Ex-1001, 8:23–33.

[15] *See, e.g.*, Ex-1001, claim 1.

the UE, to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE;

wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.[16]

C. Overview of the Prosecution History

39. Prior to allowance, the Examiner found the claims obvious in view of three references: U.S. patent Pub. No. 2013/0303224 ("Sambhwani") (Ex-1011); U.S. patent Pub. No. 2013/0183970 ("Chen") (Ex-1012); and U.S. patent Pub. No. 2014/0010207 ("Horn") (Ex-1013).[17] In response, Patent Owner did not assert that the prior art failed to disclose the claimed message flow.[18] It instead amended the

[16] I understand that Petitioners reserve the right to challenge, including under Section 112 on the basis of written description, enablement, and definiteness, the claims of the '883 patent, including, for example, the "third radio bearer" and "wherein" elements of the asserted claims. I was not asked, in this declaration, to provide an opinion on those matters.

[17] *See, e.g.*, Ex-1002, 361–370.

[18] *See, e.g.*, Ex-1002, 407–416.

claims.[19] The claims, at the time of the rejection, recited a "network node" that performed the functionality of the Challenged Claims.[20] Patent Owner then amended the claims to change the term "network node" to the "eNB" elements of the claims.[21] Patent Owner then argued that it would not have been obvious to combine the references—Chen and Horn disclose base stations (eNBs),[22] while Sambhwani discloses radio network controllers.[23] The Examiner then allowed the claims.[24] This prosecution history is consistent with my opinions that the Challenged Claims were anticipated or, at a minimum, rendered obvious by the prior art. Patent Owner's decision to not challenge the rejections on the basis that the claimed functionality was novel and nonobvious is consistent with my opinions that Centonza and Han disclose that claimed functionality. In addition, unlike each of

[19] *See, e.g.*, Ex-1002, 361–370.

[20] *See, e.g.*, Ex-1002, 361–370.

[21] *See, e.g.*, Ex-1002, 361–370.

[22] Ex-1012, Figs. 1–7; Ex-1013, Figs. 1–16.

[23] Ex-1011, Fig. 1.

[24] *See, e.g.*, Ex-1002, 428.

the combination of references that the Examiner focused on during prosecution, Centonza and Han disclose that functionality in two eNBs, as I describe in more detail below.

VI. OVERVIEW OF PRIOR ART

A. Centonza

40. Centonza, a patent assigned to Telefonaktiebolaget LM Ericsson, discloses a technique to achieve dual connectivity by handing over a subset bearers from one cell (at one eNB) to another cell (at a different eNB) as an improvement on existing LTE functionality. Centonza discloses a Primary Cell (*e.g.*, what the reference calls a "Macro cell" or an "Anchor") and a Secondary Cell (*e.g.*, what the reference calls a "Pico cell" or a "Booster" or "Assisting") as part of a heterogeneous network in which the mobile device (a type of "User Equipment" or "UE") uses multiple flows.[25]

[25] *See, e.g.*, Ex-1005, Fig. 9; Ex-1006, 87 (Fig. 8).

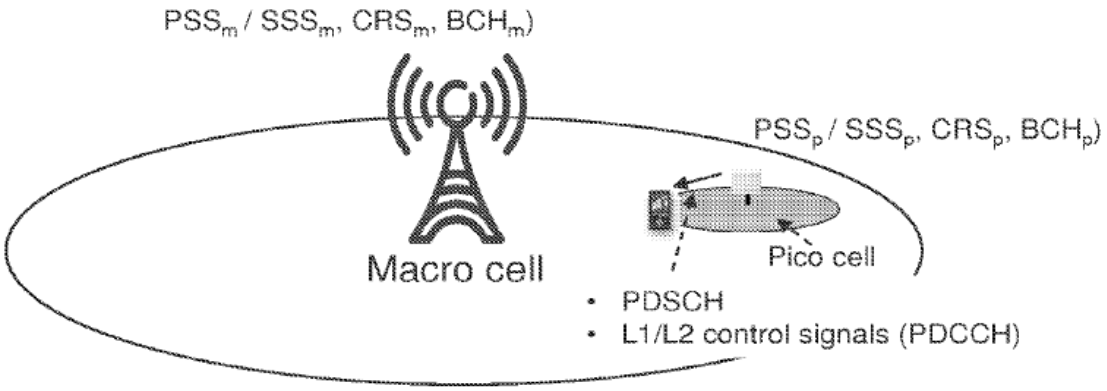


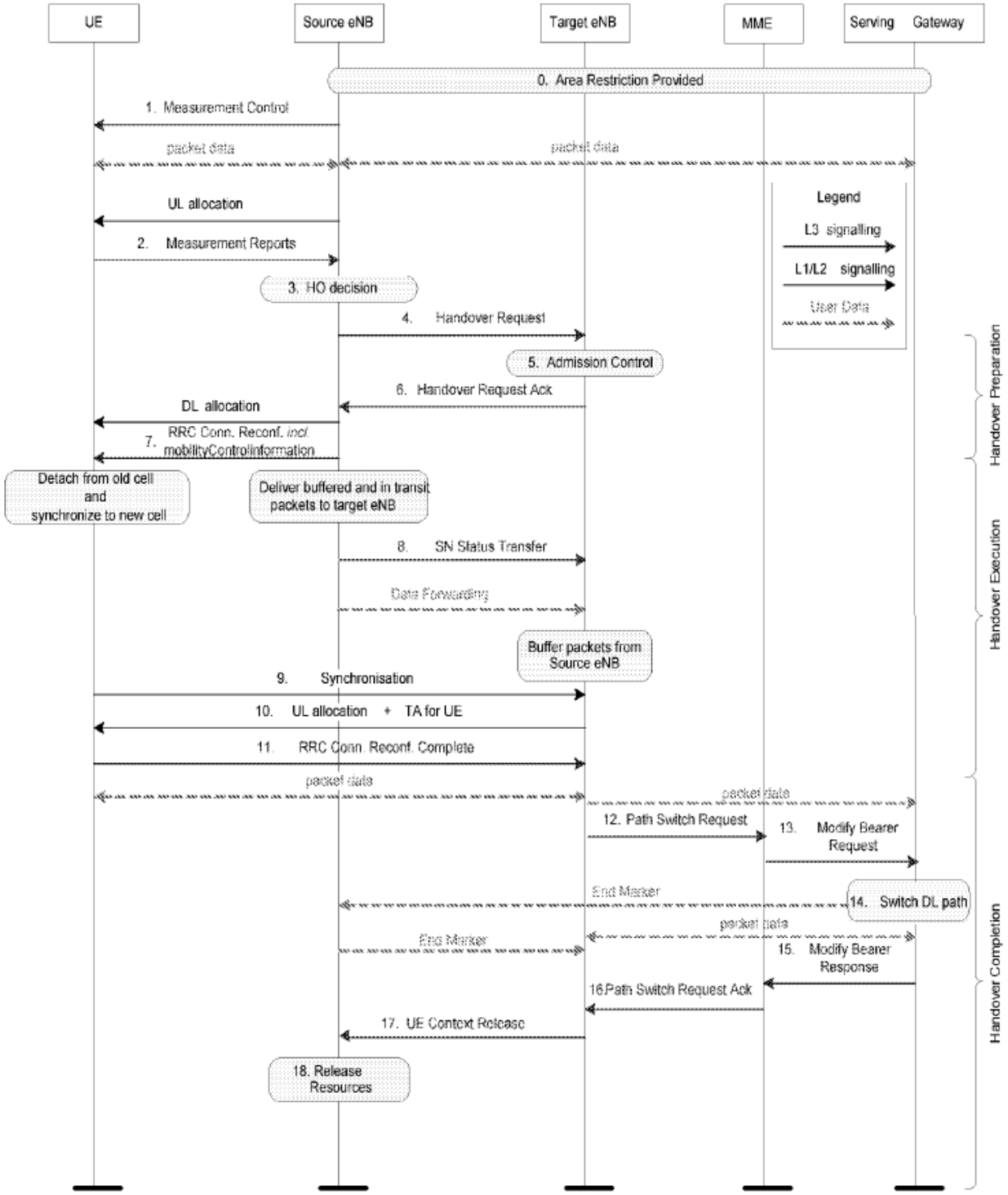
Figure 8: Heterogeneous deployment where the pico node corresponds to a cell of its own (a "pico cell"). The indices "p" and "m" indicate common signals/channels for the pico and macro cell respectively.

41. Centonza discloses a method to handle internode connectivity between the nodes.[26] It also discloses a message sequence to effectuate the dual connectivity

[26] *See, e.g.*, Ex-1005, 10:34–40 ("When both connections are active, the anchor flow may be used either for control signaling while the assisting flow is used for data. However, it will still be possible to send data also via the anchor flow. We define this case as 'multiple connectivity' or 'dual connectivity'."); Ex-1006, 26 ("For the sake of brevity, the descriptions below treat mostly the case of dual connectivity with two cells, but the ideas are equally applicable for the case where the UE is connected to more than two cells at the same time. With selective handover and multiple connectivity (P38076, P38135, P38145), only the paths of the bearers that are selectively handed over to the target are to be switched.").

via handing over a subset of bearers. These messages include a Handover Request (Step 4), Handover Request Acknowledge (Step 6), and the Path Switch Request through UE Context Release message (Steps 12–17).[27]

[27] *See, e.g.*, Ex-1005, Fig. 15; Ex-1006, 46 (Fig. 14).



42. In my opinion, as detailed below, Centonza anticipate and or renders obvious each of the Challenged Claims.

B. Han

43. Han, a patent application assigned to Broadcom, discloses a technique to achieve dual connectivity by handing over a subset bearers from one cell (at one eNB) to another cell (at a different eNB) as an improvement on existing LTE functionality. Centonza discloses a Primary Cell (*e.g.*, what the reference calls a "Macro cell") and a Secondary Cell (*e.g.*, what the reference calls a "Local area cell") as part of a heterogeneous network in which the mobile device (a type of "User Equipment" or "UE") uses multiple flows.[28]

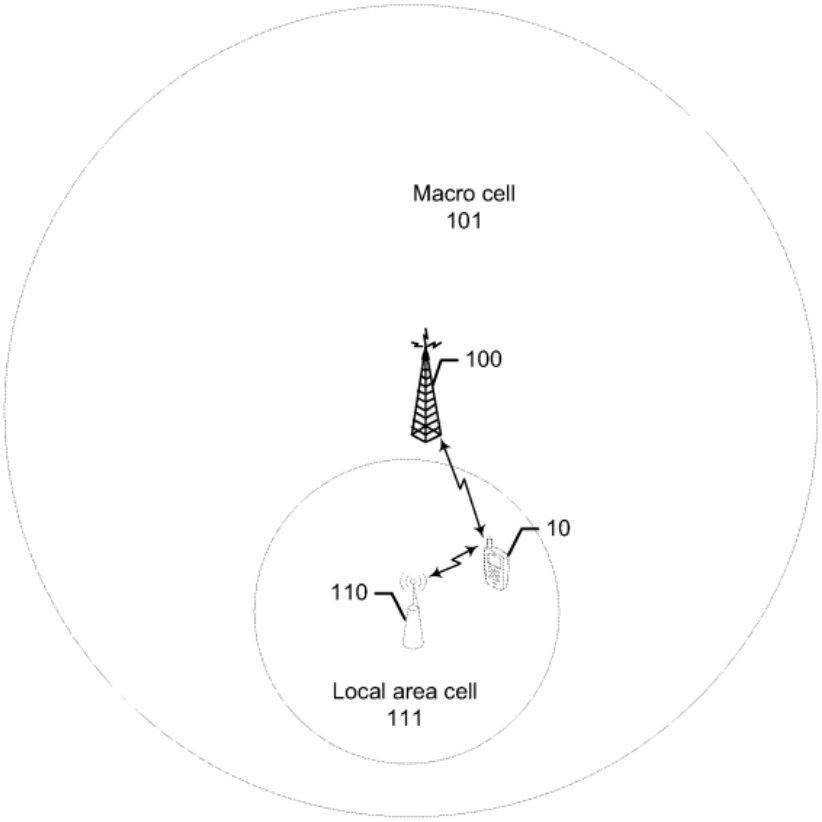
44. Han also discloses a technique to establish and manage a dual connection in cellular networks, like LTE networks.[29] It explains that "the concept of 'dual connection' has recently emerged as a way to incorporate LAs [local areas] into cellular networks."[30] "The basic idea," per Han, "is to let a user equipment (UE) connect to both a macro access point and a LA access point simultaneously, with the macro access point controlling some connection and signaling aspects, such

[28] *See, e.g.*, Ex-1007, Fig. 1.

[29] *See, e.g.*, Ex-1007, [0002]–[0003].

[30] *See, e.g.*, Ex-1007, [0002]–[0003].

as mobility functions, while offloading most data transmission to the LA access point."[31] Han depicts the macro cell (associated with a macro access point) and a local area cell (associated with a local access point) that provide dual connectivity to a user equipment, such as a mobile device.[32]



[31] *See, e.g.*, Ex-1007, [0002]–[0003].

[32] *See, e.g.*, Ex-1007, Fig. 1.

45. Han also discloses a technique to establish and manage a dual connection in cellular networks, like LTE networks.[33] Its explains that "the concept of 'dual connection' has recently emerged as a way to incorporate LAs [local areas] into cellular networks."[34] The Reference explains that "[t]he basic idea is to let a user equipment (UE) connect to both a macro access point and a LA access point simultaneously, with the macro access point controlling some connection and signaling aspects, such as mobility functions, while offloading most data transmission to the LA access point."[35] Han depicts the macro cell (associated with a macro access point) and a local area cell (associated with a local access point) that provide dual connectivity to a user equipment, such as a mobile device.[36] Figure 4 of the Han shows a sequence of messages to effectuate the dual connection functionality. That includes the Dual Connection Setup Request (Step 404), the Dual Connection Setup Response (Step 406), and the Path Switch and Suspend Request

[33] *See, e.g.*, Ex-1007, [0002]–[0003].

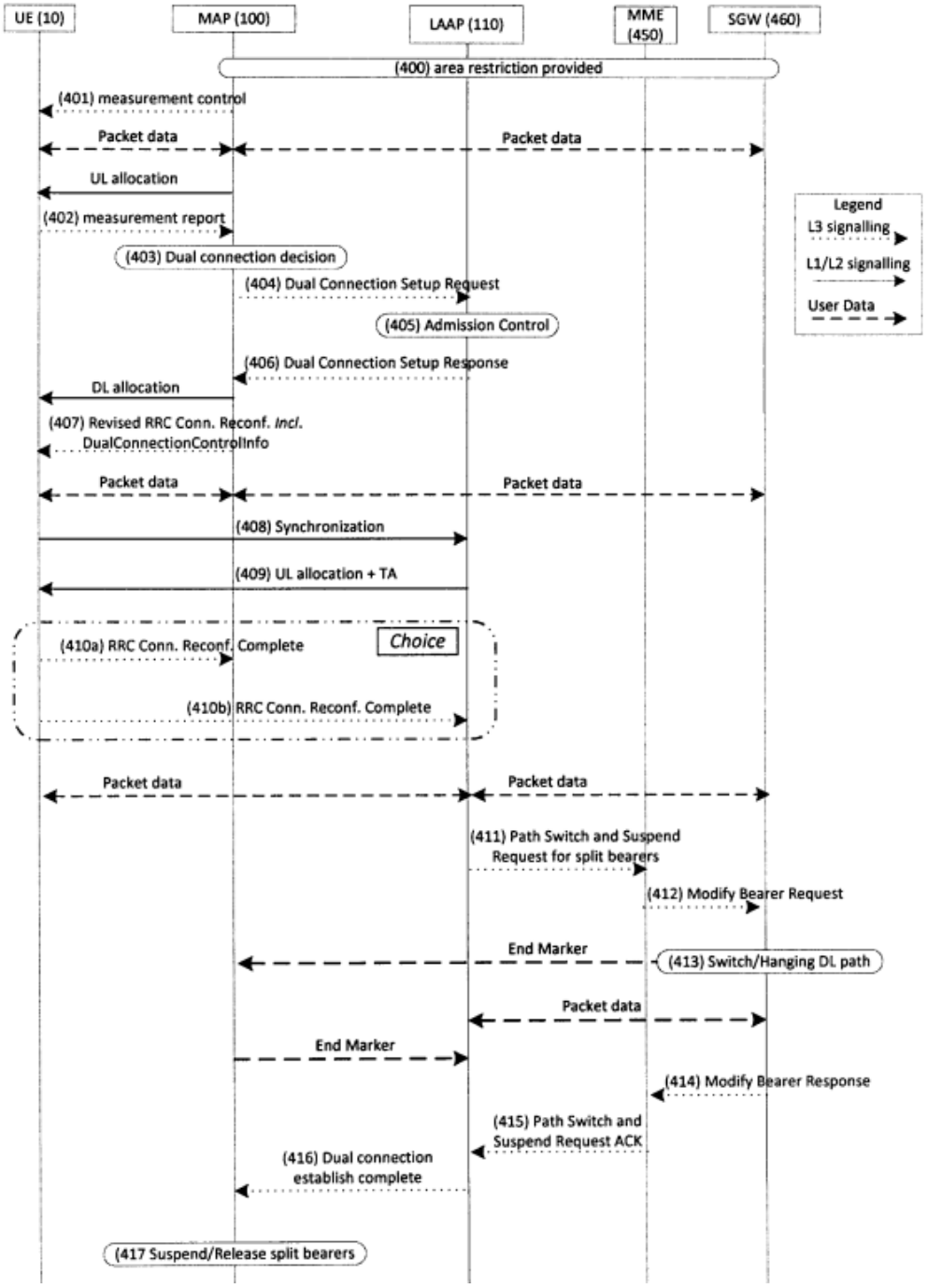
[34] *See, e.g.*, Ex-1007, [0002]–[0003].

[35] *See, e.g.*, Ex-1007, [0002]–[0003].

[36] *See, e.g.*, Ex-1007, Fig. 1.

for split bearers (Step 411) through the Dual Connection Establish Complete (Step 416).[37]

[37] *See, e.g.*, Ex-1007, Fig. 4.



VII. CLAIM CONSTRUCTION

46. I understand that claim terms are typically given their ordinary and customary meanings, as would have been understood by a person of ordinary skill in the art at the time of the alleged invention. In considering the meaning of the

claims, however, I understand that one must consider the language of the claims, the specification, and the prosecution history of record. I have been asked to consider the claim terms under their plain meanings and thus I have considered the claims, specification, and prosecution history for the ’883 patent in doing so in support of my opinions discussed herein. In addition, the prior art discussed in this Declaration, in my opinion, discloses all limitations under both the plain meaning as well as any plausible construction.

VIII. THE PRIOR ART DISCLOSES AND/OR SUGGESTS THE RECITED FEATURES OF THE CHALLENGED CLAIMS

A. Ground 1: Centonza Anticipates Each of the Challenged Claims

47. In my opinion, Centonza discloses each of the elements of each of the Challenged Claims for the reasons I explain below.

1) Centonza Is Prior Art

48. In my opinion, Centonza is prior art to the ’883 patent claims. It was filed on July 15, 2013, before the ’883 patent’s January 29, 2014 filing date, and published on July 24, 2014. Centonza claims priority to Provisional Application No. 61/678,772, which was filed on August 2, 2012, which predates the earliest filing date the ’883 patent could be entitled to (January 30, 2013), claims priority to Provisional Application No. 61/678,772 (“the Centonza Provisional”), which was

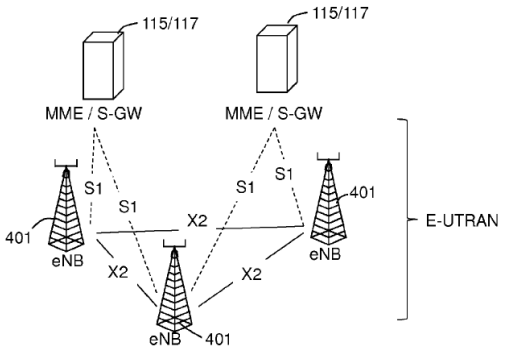
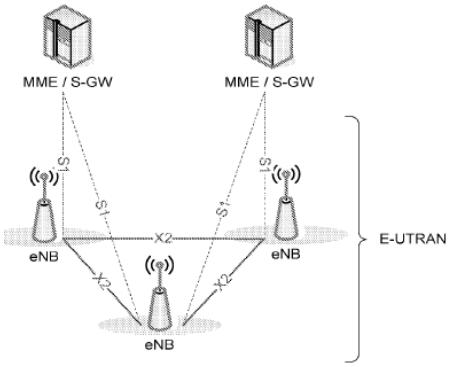
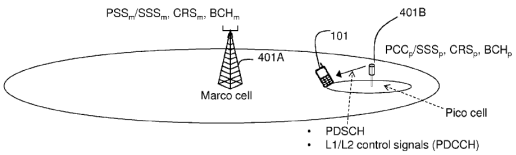
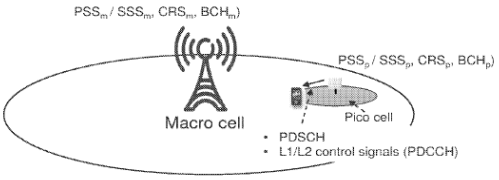
filed on August 2, 2021.[38] The Centonza Provisional discloses the subject matter of the Challenged Claims, as shown below, and supports Centonza and its claims.

49. First, Centonza and the Centonza Provisional contain virtually an identical disclosure.[39] The text of Centonza and the Centonza Provisional are very similar, with regard to the subject matter of the Challenged Claims and the elements of each Challenged Claim. I have provided parallel citations to Centonza and the Centonza Provisional for each claim element of the Challenged Claims. The Centonza Provisional contains approximately 200 pages of description of the inventions disclosed (and later claimed) in Centonza. The Centonza Provisional describes the functionalities at a source base station and target base station for providing a handover a sub-set of bearers associated with a user equipment. That includes detailing the circuitry and operations to determine a need for a handover procedure, to select a subset of bearers associated with the user equipment, to send and receive a handover request for the sub-set of bearers, to analyze rules to select the subset of bearers (*e.g.*, non-guaranteed bit rate bearers, guaranteed bit rate bearers) based on a number of parameters, including bit-rate thresholds and Quality

[38] Ex-1005, (60).

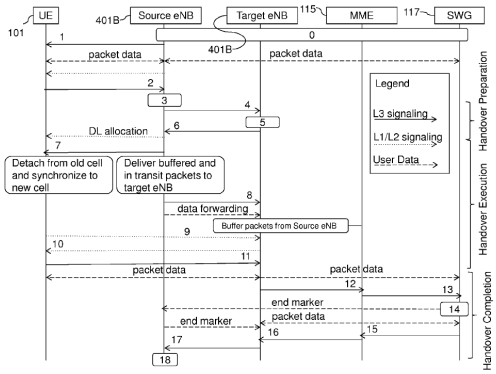
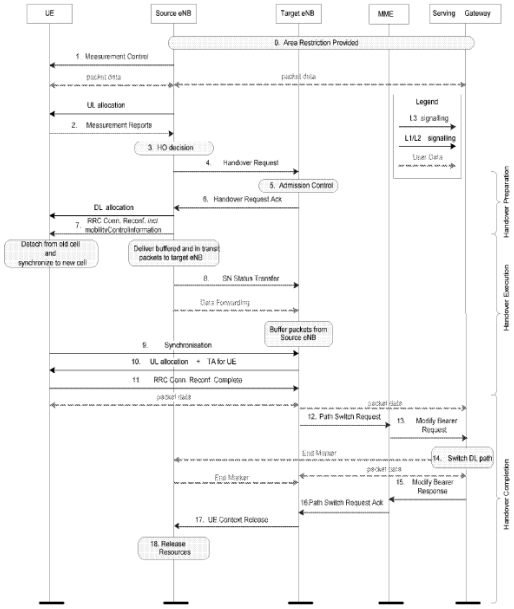
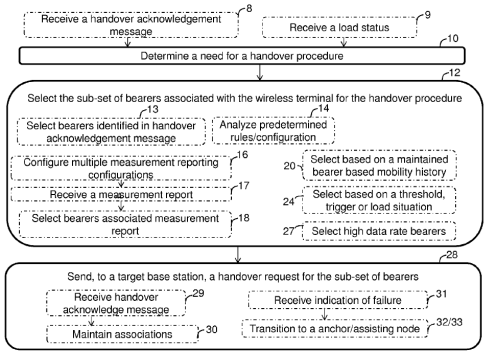
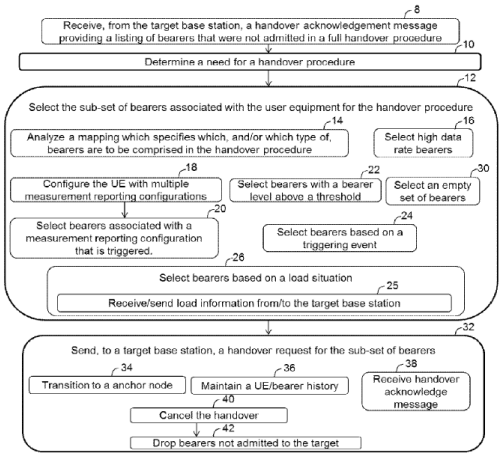
[39] *E.g.*, Ex-1005, Figs. 1–19; Ex-1006, 9–34 (Figs. 1–17), 61–62 (Figs. 18–19).

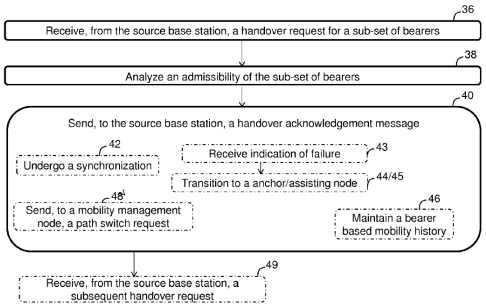
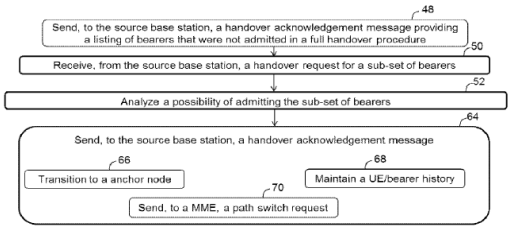
of Service ("QoS") class identifier. In addition, Centonza's figures and message structure teachings are found in the Centonza Provisional, including the teachings that, in my opinion, disclose each element of the Challenged Claims. Below are some examples from the figures that show the Centonza Provisional discloses the subject matter in Centonza.

Centonza	**Centonza Provisional**
 FIGURE 2 (Ex-1005, Fig. 2)	 Figure 1: Overall E-UTRAN Architecture (Ex-1006, 9 (Fig. 1))
 FIGURE 9 (Ex-1005, Fig. 9)[40]	 Figure 8: Heterogeneous deployment where the pico node corresponds to a cell of its own (a "pico cell"). The indices "p" and "m" indicate common signals/channels for the pico and macro cell respectively. (Ex-1006, 15 (Fig. 8))[41]

[40] *See, e.g.*, Ex-1005, Figs. 8, 9, 10, 11, and 12.

[41] *See, e.g.*, Ex-1006, 15–17 (Figs. 7, 8, 9, 10, and 11).

Centonza	Centonza Provisional
 FIGURE 15 (Ex-1005, Fig. 15) (Handover Message Process)	 Figure 14: X2 Handover in LTE (Ex-1006, 46 (Fig. 14)) (Handover Message Process)
 FIGURE 18 (Ex-1005, Fig. 18) (Flow Diagram for Source eNB)	 Figure 18 – flow diagram of example operations of a source base station (Ex-1006, 61 (Fig. 18)) (Flow Diagram for Source eNB)

Centonza	Centonza Provisional
 FIGURE 19 (Ex-1005, Fig. 19) (Flow Diagram for Target eNB)	 Figure 19 – flow diagram of example operations of a target base station (Ex-1006, 62 (Fig. 19)) (Flow Diagram for Target eNB)[42]
TABLE 1 X2 HANDOVER REQUEST message Presence IE/Group Name Message Type M Old eNB UE X2AP ID M Cause M Target Cell ID M GUMMEI M UE Context Information >MME UE S1AP ID M >UE Security Capabilities M >AS Security Information M >UE Aggregate Maximum Bit Rate M >Subscriber Profile ID for RAT/Frequency priority O >E-RABs To Be Setup List >>E-RABs To Be Setup Item >>>E-RAB ID M >>>E-RAB Level QoS Parameters M >>>DL Forwarding O >>>UL GTP Tunnel Endpoint M >RRC Context M >Handover Restriction List O >Location Reporting Information O >Management Based MDT Allowed O UE History Information M Trace Activation O SRVCC Operation Possible O CSG Membership Status O (Ex-1005, 17:5–35) (X2 HANDOVER REQUEST)	Table 1: X2 HANDOVER REQUEST message IE/Group Name — Presence Message Type — M Old eNB UE X2AP ID — M Cause — M Target Cell ID — M GUMMEI — M **UE Context Information** >MME UE S1AP ID — M >UE Security Capabilities — M >AS Security Information — M >UE Aggregate Maximum Bit Rate — M >Subscriber Profile ID for RAT/Frequency priority — O **>E-RABs To Be Setup List** **>>E-RABs To Be Setup Item** >>>E-RAB ID — M >>>E-RAB Level QoS Parameters — M >>>DL Forwarding — O >>>UL GTP Tunnel Endpoint — M >RRC Context — M >Handover Restriction List — O >Location Reporting Information — O >Management Based MDT Allowed — O UE History Information — M Trace Activation — O SRVCC Operation Possible — O CSG Membership Status — O (Ex-1006, 50) (X2 HANDOVER REQUEST)

[42] *See, e.g.*, Ex-1006, 34 (Fig. 19).

<table>
<tr><th>Centonza</th><th>Centonza Provisional</th></tr>
<tr><td>

TABLE 8

X2 HANDOVER REQUEST ACKNOWLEDGE message

IE/Group Name	Presence
Message Type	M
Old eNB UE X2AP ID	M
New eNB UE X2AP ID	M
E-RABs Admitted List	
> E-RABs Admitted Item	
>> E-RAB ID	M
>> UL GTP Tunnel Endpoint	O
>> DL GTP Tunnel Endpoint	O
E-RABs Not Admitted List	O
Target eNB To Source eNB Transparent Container	M
Criticality Diagnostics	O

(Ex-1005, 22:2–18)
(X2 HANDOVER REQUEST)

</td><td>

Table 8: X2 HANDOVER REQUEST ACKNOWLEDGE message

IE/Group Name	Presence
Message Type	M
Old eNB UE X2AP ID	M
New eNB UE X2AP ID	M
E-RABs Admitted List	
> E-RABs Admitted Item	
>> E-RAB ID	M
>> UL GTP Tunnel Endpoint	O
>> DL GTP Tunnel Endpoint	O
E-RABs Not Admitted List	O
Target eNB To Source eNB Transparent Container	M
Criticality Diagnostics	O

(Ex-1006, 55)
(X2 HANDOVER REQUEST ACKNOWLEDGE)

</td></tr>
<tr><td>

TABLE 1a

PATH SWITCH REQUEST message

IE/Group Name	Presence	Range	Semantics description	Criticality	Assigned Criticality
Message Type	M			YES	reject
eNB UE S1AP ID	M			YES	reject
E-RAB To Be Switched in Downlink List		1		YES	reject
>E-RABs Switched in Downlink Item IEs		1 to <maxnoof E-RABs>		EACH	reject
>>E-RAB ID	M			—	
>>Transport layer address	M			—	
>>GTP-TEID	M		To deliver DL PDUs	—	

TABLE 1a-continued

PATH SWITCH REQUEST message

IE/Group Name	Presence	Range	Semantics description	Criticality	Assigned Criticality
Source MME UE S1AP ID	M			YES	reject
E-UTRAN CGI	M			YES	ignore
TAI	M			YES	ignore
UE Security Capabilities	M			YES	ignore
CSG Id	O			YES	ignore
Cell Access Mode	O			YES	ignore
Source MME GUMMEI	O			YES	ignore
Selective Handover Indicator	O	ENUMER-ATED (true, . . .)	This IE indicates to MME that the handover is selective. IT helps MME to decide whether to maintain bearers not listed in the E-RABs To Be Switched In Downlink List	YES	ignore

(Ex-1005, 18:48–19:23)
(PATH SWITCH REQUEST)

</td><td>

IE/Group Name	Presence	Range	Semantics description	Criticality	Assigned Criticality
Message Type	M			YES	reject
eNB UE S1AP ID	M			YES	reject
E-RAB To Be Switched in Downlink List		*1*		YES	reject
>E-RABs Switched in Downlink Item IEs		*1 to <maxnoof E-RABs>*		EACH	reject
>>E-RAB ID	M			-	
>>Transport layer address	M			-	
>>GTP-TEID	M		To deliver DL PDUs	-	
Source MME UE S1AP ID	M			YES	reject
E-UTRAN CGI	M			YES	ignore
TAI	M			YES	ignore
UE Security Capabilities	M			YES	ignore
CSG Id	O			YES	ignore
Cell Access Mode	O			YES	ignore
Source MME GUMMEI	O			YES	ignore
Selective Handover Indicator	O	ENUMERATED (true, …)	This IE indicates to MME that the handover is selective. IT helps MME to decide whether to maintain bearers not listed in the E-RABs To Be Switched In Downlink List	YES	ignore

(Ex-1006, 52 (PATH SWITCH REQUEST))

</td></tr>
</table>

50. I have also been asked to consider if the disclosure of the Centonza Provisional provides written description support for at least one issued claim of Centonza. In my opinion, the Centonza Provisional provides such support.

Centonza and the Centonza Provisional contain a very similar disclosure, as I detail above, including with regard to the network and message structure and message flow. Below is a table that provides exemplary support from the Centonza Provisional for claim 25 of Centonza (Ex-1005, claim 25).

Centonza	Centonza Provisional
25. A method, in a target base station in a wireless communications network, for providing a handover for a sub-set of bearers associated with a wireless terminal being served by a source base station, said sub-set of bearers being less than or equal to all bearers associated with the wireless terminal, the method comprising:	The application utilizes a wireless communication network, which includes a source base station and a target base station.[43] It discloses, in a target base station, providing a handover for a sub-set of bearers associated with a wireless terminal being served by a source base station, said sub-set of bearers being less than or equal to all bearers associated with the wireless terminal.[44]

[43] *See, e.g.*, Ex-1006, 58–62.

[44] *See, e.g.*, Ex-1006, 61–62 (showing handover of a "sub-set of bearers" and depicting "example operations which may be taken by the target base station ... in the providing a handover of at least a sub-set of bearers associated with a user equipment."); *id.*, 47 (describing "a selective handover of only a subset of the UE bearers"); *id.*, 73–78 (describing embodiments where the target base station receives a selective handover request); *id.*, 73 ("41. A method, in a target base

Centonza	Centonza Provisional
receiving, from the source based station, a handover request for the sub-set of bearers, wherein a least one bearer of the wireless terminal is to remain connected to the source base station	The application discloses, receiving, from the source based station, a handover request for the sub-set of bearers, wherein a least one bearer of the wireless terminal is to remain connected to the source base station.[45]
analyzing an admissibility of the sub-set of bearers with respect to the handover procedure	The application discloses analyzing an admissibility of the sub-set of bearers

station, for providing a handover of at least a sub-set of bearers associated with a user equipment, the method comprising:").

[45] *See, e.g.*, Ex-1006, 62 (showing the target base station "[r]eceive[s], from the source base station, a handover request for a sub-set of bearers"); *id.*, 73 ("receiving (**50**), from a source base station, a handover request for the sub-set of bearers associated with the user equipment"); *id.*, 106 (explaining that "at least one bearer (which is not associated with the identified sub-set) remains connected to the base station" as part of handover procedure); *id.*, 112 (explaining that at least one bearer "remains connected to the base station").

Centonza	Centonza Provisional
	with respect to the handover procedure.[46]
sending, to the source base station, a handover acknowledgement message comprising a result of the analyzed admissibility; and	The application discloses sending, to the source base station, a handover acknowledgement message comprising a result of the analyzed admissibility.[47]
receiving, from the source base station, at least one subsequent handover request, wherein each subsequent handover request is treated as a handover request for only a sub-set of bearers associated with the wireless terminal.	The application discloses receiving, from the source base station, at least one subsequent handover request, wherein each subsequent handover request is treated as a handover request for only a sub-set of bearers associated with the wireless terminal.[48]

[46] *See, e.g.*, Ex-1006, 62 (showing the target base station "[a]nalyze[s] a possibility of admitting the sub-set of bearers"); *id.* at 73 ("analyzing (**52**) suitability of possibility of admitting the sub-set of bearers comprises in the handover request").

[47] *See, e.g.*, Ex-1006, 61–62 (showing the target base station "send[s], to the source base station, a handover acknowledgement message");

id. at 74 ("sending (**64**), to the source base station, a handover request acknowledgement comprising a result of analyzing").

[48] *See, e.g.*, Ex-1006, 50 ("In case the target eNB receives multiple selective handover requests concerning the same UE from the same source eNB, it shouldn't

2) Claim 1

a) *[Preamble]: A method for handling inter-node connectivity in a wireless communication system, comprising:*

51. I have not been asked to assess whether the preamble is a claim limitation. However, to the extent that the preamble is limiting, Centonza discloses the preamble.

52. The '883 patent explains that the prior art provided a way to handle inter-node connectivity with a wireless communications system, namely that 3GPP RWS-120046 (the Samsung presentation) disclosed inter-eNB carrier aggregation in which the macro and small cells are controlled by different eNBs (the "Serving eNB" controls a macro cell and a "Drift eNB" controls a small cell).[49]

be interpreted as an error, but rather as a request to selectively hand over even more bearers of the UE towards the target."); *id.*, 74 (same); *id.*, 62 (showing target base station "[r]eceive[s], from the source base station, a handover request for a sub-set of bearers"); *id.*, 112 (explaining that at least one bearer "remains connected to the base station").

[49] *See, e.g.*, Ex-1001, 5:39–51; *id.*, Fig. 5; Ex-1008, 20.

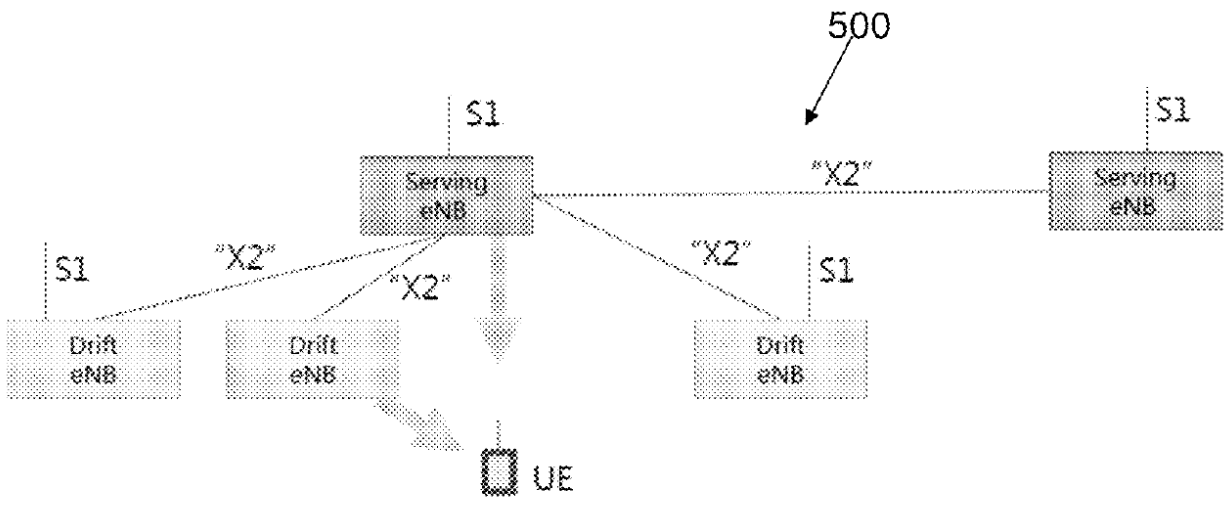


FIG. 5 (PRIOR ART)

53. Centonza, including as described in the Centonza Provisional, provides a method for handling inter-node connectivity in a wireless communications system.

54. Centonza explains that it provides a method to handle the connectivity between nodes (*e.g.*, an anchor node and an assisting node) in a wireless communication system (*e.g.*, a cellular network such as LTE networks).

55. Centonza, for example, discloses a Primary Cell (*e.g.*, what the reference calls a "Macro cell" or an "Anchor") and a Secondary Cell (*e.g.*, what the reference calls a "Pico cell" or a "Booster" or "Assisting") as part of a heterogeneous

network in which the mobile device (a type of "User Equipment" or "UE") uses multiple flows.[50]

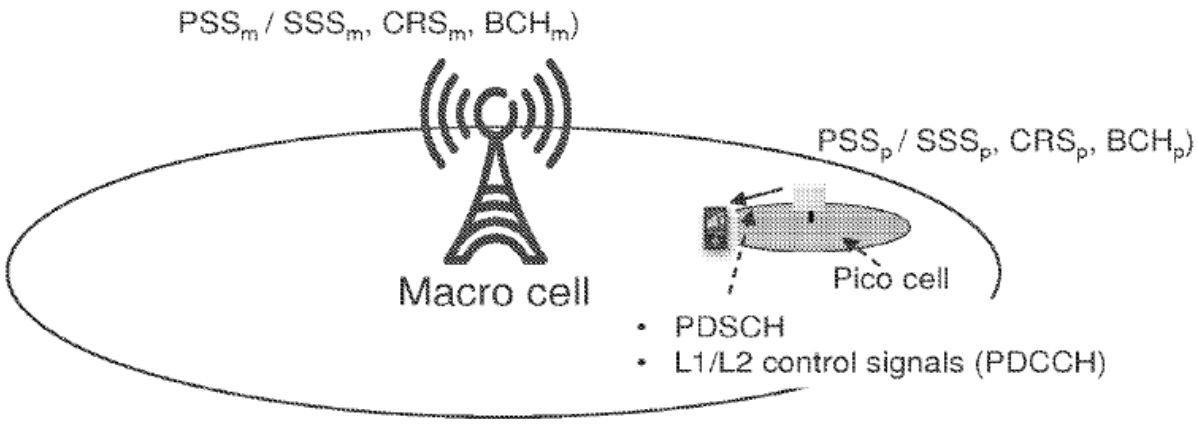


Figure 8: Heterogeneous deployment where the pico node corresponds to a cell of its own (a "pico cell"). The indices "p" and "m" indicate common signals/channels for the pico and macro cell respectively.

56. Centonza discloses a method to handle internode connectivity between the nodes. For example, Centonza discloses "multiple connectivity" or "dual connectivity" when it is possible to send to send data via the anchor flow and

[50] *See, e.g.*, Ex-1006, 15–17 (disclosing a "Marco cell" and "Pico cell" and an "Anchor" and a Booster" in Figures); Ex-1005, Figs. 1, 12 (disclosing an "Anchor" base station and "Assisting" base station); *id.*, Fig. 8 (disclosing a "Macro node" and a "Pico node"); *id.*, Fig. 9 (disclosing a "Macro cell" and a "Pico cell").

assisting flow.[51] The title of Centonza is "Node and Method For Handing Over a Sub-Set of Bearers to Enable Multiple Connectivity of a Terminal Towards Several Base Stations."[52]

57. The Centonza Provisional likewise discloses "dual connectivity with two cells" as well as "multiple connectivity."[53] The disclosure "dual connectivity"

[51] *See, e.g.*, Ex-1005, 10:34–40 ("When both connections are active, the anchor flow may be used either for control signaling while the assisting flow is used for data. However, it will still be possible to send data also via the anchor flow. We define this case as "multiple connectivity" or "dual connectivity."); Ex-1006, 15–16; *see also id.*, 26 (disclosing "dual connectivity").

[52] *See, e.g.*, Ex-1005, (54).

[53] *See, e.g.*, Ex-1006, 26 ("For the sake of brevity, the descriptions below treat mostly the case of dual connectivity with two cells, but the ideas are equally applicable for the case where the UE is connected to more than two cells at the same time. With selective handover and multiple connectivity (P38076, P38135, P38145), only the paths of the bearers that are selectively handed over to the target are to be switched.").

and "multiple connectivity" cases in Centonza and the Centonza Provisional teach handling inter-node connectivity in a wireless communication system.

58. Centonza, including as detailed in the Centonza Provisional, also discloses that the macro cell and small cell are controlled by different eNBs. The figure above (Figure 8 from the Centonza Provisional) describes a "[h]eterogenous deployment where the pico node corresponds to a call of its own (a 'pico cell')"). Centonza likewise explains that a "macro node" may "correspond to currently described macro cells" and a "pico node" may "correspond to a cell of its own ('pico cell')," which Centonza depicts in Figure 9.[54]

[54] *See, e.g.*, Ex-1005, 9:34–41 ("In practice, the macro nodes 401A may correspond to currently deployed macro cells while the pico nodes 401B are later deployed nodes, extending the capacity and/or achievable data rates within the macro-cell coverage area where needed. A pico node 401B of a heterogeneous deployment may correspond to a cell of its own (a 'pico cell'), as illustrated in FIG. 9.").

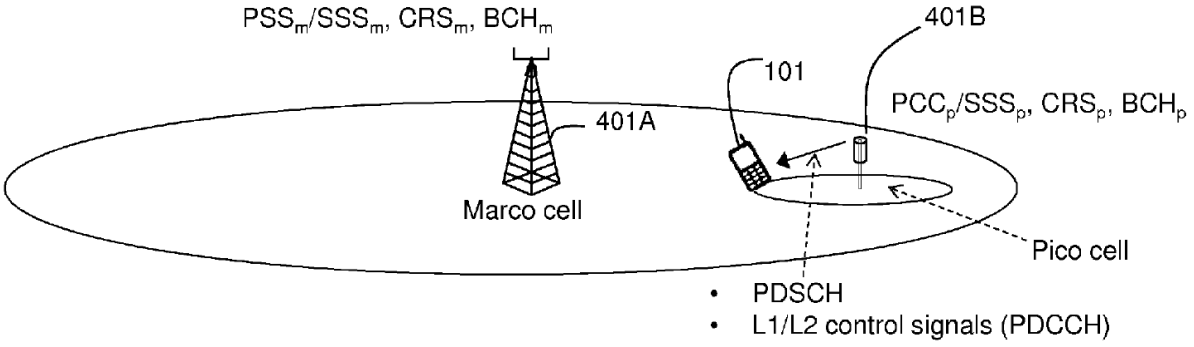


FIGURE 9

59. Centonza similarly discloses that the Target eNB does not belong to the same soft cell as the Source eNB.[55]

60. Centonza, including as detailed in the Centonza Provisional, discloses a method for handling internode connectivity, as I detail below. For example, the reference teaches techniques to handle interconnectivity by aggregating carriers by handing over a subset of bearers.

[55] *See, e.g.*, Ex-1005, 15:57–62 ("According to some of the example embodiments, the target eNB does not belong to the same soft cell as the source eNB, for example, the target eNB an independent eNB such as a neighbor macro eNB or a pico eNB operating as a standalone cell. That is, for the concerned user equipment, the target eNB will play the role of the assisting eNB.").

61. Thus, because the two nodes each have a cell of their own (*e.g.*, the macro node corresponds to a macro cell and a pico node corresponds to a pico cell), this means that the connectivity is "inter-node."[56]

62. For the reasons discussed above, Centonza, including material in the Centonza Provisional, disclose this claim element in my opinion.

> *b) [1b]: receiving, by a first evolved node B (eNB), a first request from a second eNB for aggregating a Secondary Cell (SCell) for a User Equipment (UE);*

63. Centonza, including as detailed in the Centonza Provisional, discloses receiving, by a first evolved node B (called an "eNB"), a first request from a second eNB for aggregating a Secondary Cell (called a "SCell") for a User Equipment (also known as a "UE").

64. Centonza, including as described in the Centonza Provisional, discloses at least two eNBs, which has been a concept that predates the '883 patent in

[56] *See, e.g.*, Ex-1005, 9:34–41, 16:57–62; Ex-1006, 15–16; *see also id.*, 26 (disclosing "dual connectivity"); Ex-1005, 10:34–40 (disclosing "dual connectivity").

numerous cell phone standards, including the standards for the Long-Term Evolution ("LTE" or "4G") standards.[57]

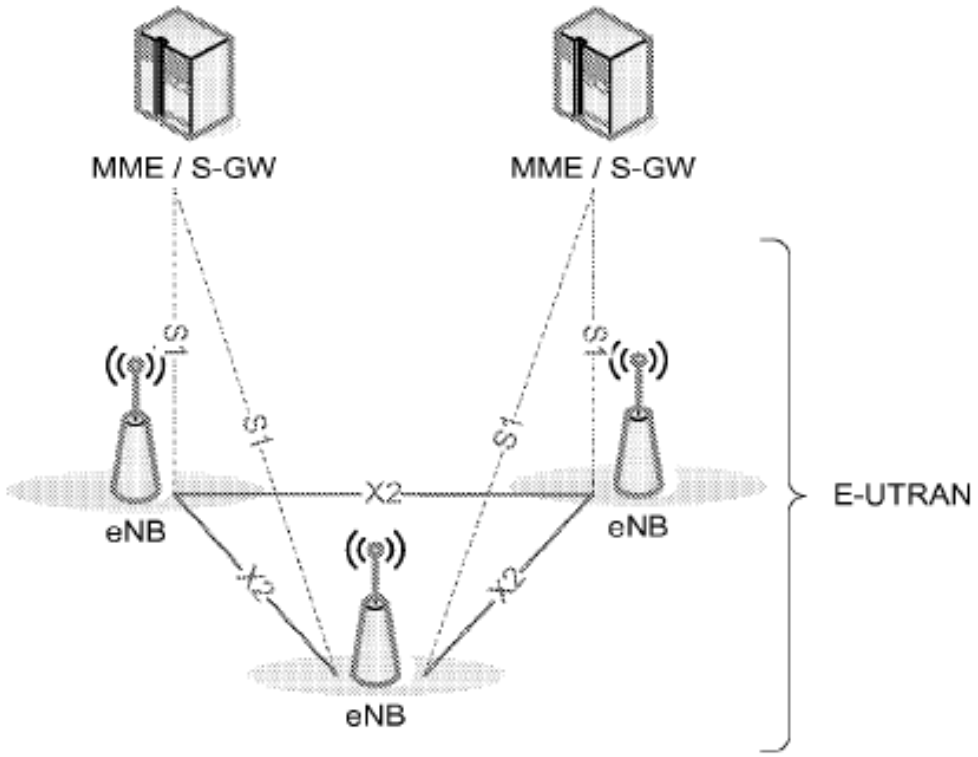


Figure 1: Overall E-UTRAN Architecture

65. This E-UTRAN Architecture predates the '883 patent, as the RWS-1200046 Samsung Presentation (which the '883 patent incorporates by reference) discloses.[58]

[57] *See, e.g.*, Ex-1006, 9 (Fig. 1). Centonza discloses this figure. Ex-1005, Fig. 2.

[58] *See, e.g.*, Ex-1008, 19 (depicting similar figure).

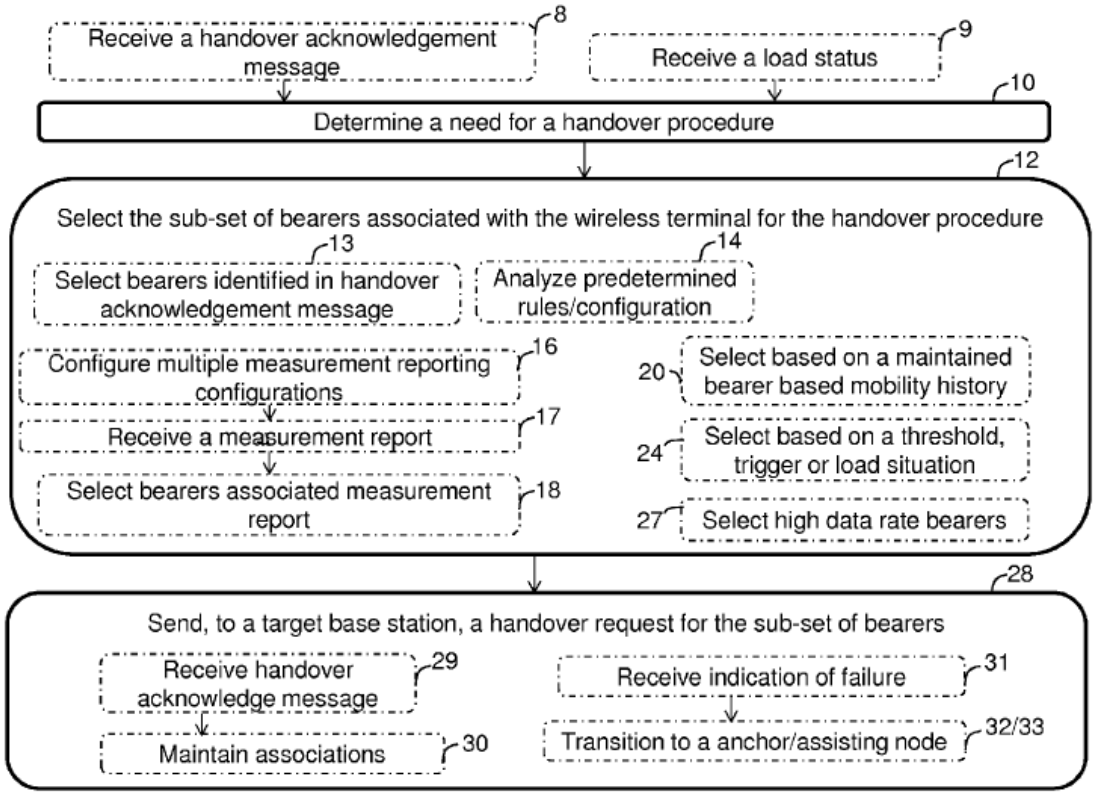
66. Centonza explains that "the wireless network may comprise at least one macro and at least one pico, or another macro, node or cell in another carrier or same carrier, frequency for high data rate boosting."[59] One example of the selective handover is to select the high-data rate bearers for a handover procedure to the node or cell (*e.g.*, a pico or another macro node or cell).[60]

67. Centonza explains that the process begins with a Source Base Station that sends "to the target base station, a handover request for the sub-set of bearers, wherein at least one bearer of the wireless terminal remains connected to the source base station," where the bearer may be an SRB (a signaling radio bearer) or a DRB

[59] *See, e.g.*, Ex-1005, 27:39–49; Ex-1006, 48 (similar).

[60] *See, e.g.*, Ex-1005, 27:39–49, Fig. 18; Ex-1006, 48 (similar), 61 (Fig. 18).

(a data radio bearer).[61] Centonza depicts this in Figure 18, which shows sending the request in step 28.[62]

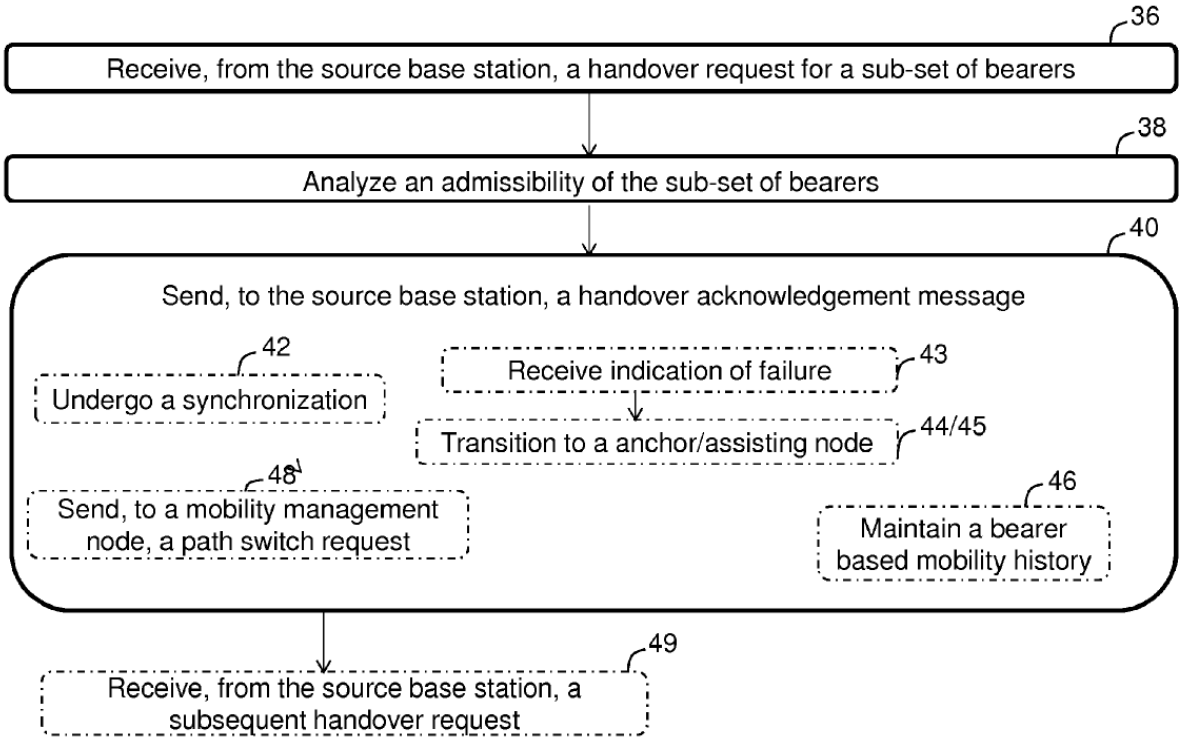


[61] *See, e.g.*, Ex-1005, 3:37–41, 7:14–26; Ex-1006, 61 (Fig. 18); *id.*, 106 (explaining that "at least one bearer (which is not associated with the identified sub-set) remains connected to the base station" as part of handover procedure); *id.*, 112 (explaining that at least one bearer "remains connected to the base station"); *id.*, 11 (describing DRBs and SRBs).

[62] *See, e.g.*, Ex-1005, Fig. 18; Ex-1006, 61 (Fig. 18) (step 32).

68. Thus, Centonza, including as taught in the Centonza Provisional, teaches that the second eNB (*e.g.*, the Source Base Station) sends a first request to a first eNB (*e.g.*, the Target Base Station).

69. Similarly, Centonza, including as taught in the Centonza Provisional, teaches that the first eNB (*e.g.*, the Target Base Station), receives a first request from a second eNB (*e.g.*, the Source Base Station). This is depicted in Figure 19 of Centonza.[63]



[63] *See, e.g.*, Ex-1005, Fig. 19; Ex-1006, 62 (Fig. 19).

70. As Figure 19 shows, for example, the Target Base Station "receive[s], from the source base station, a handover request for a sub-set of bearers."[64]

71. Centonza explains that the number of bearers that are handed over is "less than or equal to a total number of bearers associated with the wireless terminal," *i.e.*, at least one bearer is not handed over (and there is no request to change the data path for that third radio bearer).[65]

[64] *See, e.g.*, Ex-1005, Fig. 19; Ex-1006, 62 (Fig. 19).

[65] Ex-1005, 3:7–8; *id.*, 29:2–5 (describing a handover request "for a sub-set of bearers, wherein at least one bearer of the wireless terminal is to remain connected to the source base station"); Ex-1006, 106 (explaining that "at least one bearer (which is not associated with the identified sub-set) remains connected to the base station" as part of handover procedure); *id.*, 112 (explaining that at least one bearer "remains connected to the base station"). A POSITA would have understood that there were at least 11 data radio bearers for a UE in the LTE-based partial handover system that Centonza describes (and potentially up to 256). Ex-1005, 1:20–2:36, Figs. 4 and 5 (describing protocol stack for LTE); Ex-1006, 11–12 (Figs. 3 and 4), 27, 91 (similar); Ex-1009, 281 (reciting that the maximum number of data radio bearers is 11); Ex-1001, 2:47–64 (incorporating by reference 3GPP TS 36.331

72. Centonza explains that "a source eNB may decide to initiate a selective handover of a subset of the bearers of a user equipment towards a target eNB. Several mechanisms can be employed by the source eNB to decide which bearers to choose for the selective handover,"[66] and provides an example of a request that is provided

V11.2.0); Ex-1006, 150, 152, 210, 211(disclosing a range of "E-RABs Switched in Downlink" and "E-RAB To Be Setup" with a range of "1 to <maxnoofE-RABs>"); Ex-1005, 18:46–19:24 (similar); *id.*, (56) (listing 3GPP TS 36.413 V10.2.0 as references cited); Ex-1010, 9.1.3.1–9.1.3.7, 9.1.4.1, 9.1.4.3, 9.1.5.2, 9.1.5.4, 9.1.5.5, 9.1.5.8, 9.1.5.9, 9.1.9.1, 9.1.2.7, 9.2.1.31, 9.2.1.36 (explaining that the value maxnoofE-RABs refers to the "[m]aximum no. of E-RABs towards one UE, the maximum value is 256").

[66] *See, e.g.*, Ex-1005, 15:24–28; *see also id.*, 17:36–40 ("According to some of the example embodiments, the target eNB is informed that a given handover is a selective handover rather than a legacy handover, for example, a full handover where all the bearers of the user equipment have to be handed over, during handover preparation signaling. In case the target eNB receives multiple selective handover requests concerning the same user equipment from the same source eNB, it shouldn't

over the X2 interface through which two eNBs may communicate (the X2 HANDOVER REQUEST message).[67]

be interpreted as an error, but rather as a request to selectively hand over even more bearers of the user equipment towards the target."); Ex-1006, 48.

[67] *See, e.g.*, Ex-1006, 50; Ex-1005, 17:5–18:24.

TABLE 1

X2 HANDOVER REQUEST message	
	Presence
IE/Group Name	
Message Type	M
Old eNB UE X2AP ID	M
Cause	M
Target Cell ID	M
GUMMEI	M
UE Context Information	
>MME UE S1AP ID	M
>UE Security Capabilities	M
>AS Security Information	M
>UE Aggregate Maximum Bit Rate	M
>Subscriber Profile ID for RAT/Frequency priority	O
>E-RABs To Be Setup List	
>>E-RABs To Be Setup Item	
>>>E-RAB ID	M
>>>E-RAB Level QoS Parameters	M
>>>DL Forwarding	O
>>>UL GTP Tunnel Endpoint	M
>RRC Context	M
>Handover Restriction List	O
>Location Reporting Information	O
>Management Based MDT Allowed	O
UE History Information	M
Trace Activation	O
SRVCC Operation Possible	O
CSG Membership Status	O

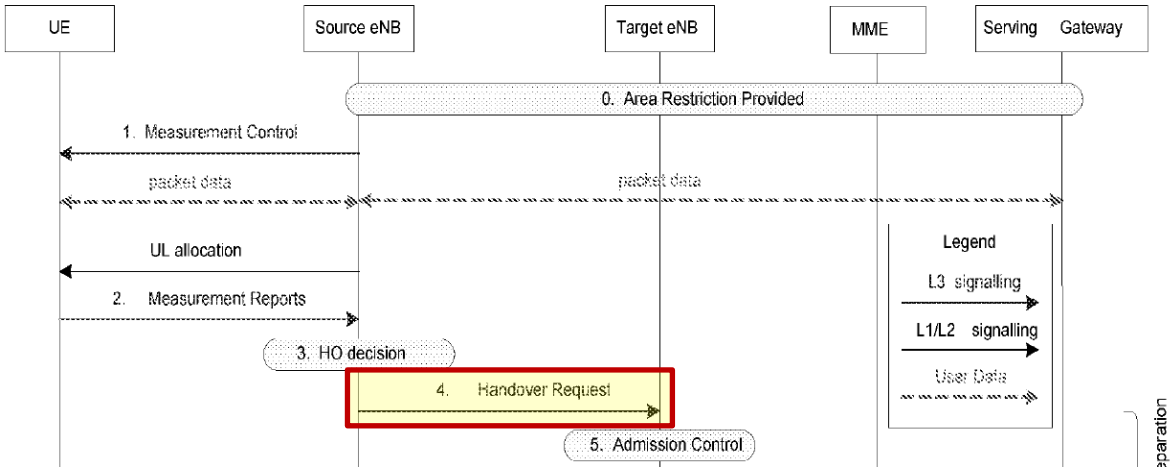
73. Centonza explains that this X2 HANDOVER REQUEST message (which is from the legacy LTE specification) can be used for selective handover "already comprises a list of E-RABs [E-UTRAN Radio Access Bearers] to be setup. For the case of selective handover, this list may also be used to cover the data radio

bearers that the anchor wants to handover to the assisting cell. The rest of the E-RABs will remain at the source eNB. So, this list may be used as is."[68]

74. Centonza also depicts the Handover Request from the Source eNB to the Target eNB (shown in step 4 below in the portion of Figure 14 from the Centonza Provisional shown below and highlighted).[69]

[68] *See, e.g.*, Ex-1005, 18:9–24; Ex-1006, 51. Centonza similarly explains that, when the HANDOVER REQUEST message includes a partial list of E-RABs, *e.g.*, a partial handover of a subset of the bearers, the Target Base Station is assumed to send a PATH SWITCH REQUEST switch message listing the subset of bearers, which, under the current specifications that existed at the time, would reflect completing a partial handover of the subset of bearers. Ex-1005, 18:48–19:23; Ex-1006, 52.

[69] *See, e.g.*, Ex-1006, 46 (Fig. 14); Ex-1005, Fig. 15 (depicting the same steps).



75. The Handover Request detailed in Centonza is a request to aggregate a Secondary Cell (called an "SCell") for a User Equipment (called a "UE").

76. The '883 patent explains that a Primary Cell (called a "PCell") can be a macro cell and the Secondary Cell could be a small cell.[70] Centonza, including as disclosed in the Centonza Provisional, discloses macro cells and pico cells (and an anchor cell and a booster/assisting cell), as I detail in the section above. Centonza also discloses a "Primary serving cell" (or "PCell") and a "secondary cell" (or "SCell"), including that the Target eNB controls the SCell and the Source eNB controls the PCell, which the reference explains are concepts that existed since at

[70] *See, e.g.*, Ex-1001, 5:66–67 ("The PCell could be a macro cell, and the SCell could be a small cell.").

least the LTE standards available at the time.[71] Centonza thus discloses the PCell and SCell elements of the '883 'patent.

77. The request that the Target Base Station receives is a request to aggregate a Secondary Cell for a User Equipment. The request in Centonza is "a handover request for a sub-set of bearers."[72] A request to handover a subset of bearers from the Source Base Station to the Target Base Station for a UE (such as a mobile device) is a request to aggregate a secondary cell (*e.g.*, adding the subset of bearers handed over to the secondary cell) for that particular UE.

78. Centonza explains that its selective handover techniques "may be a handover of a sub-set of bearers associated with user equipment."[73] Centonza explains that, in the embodiments it discloses, includes selecting bearers for a

[71] *See, e.g.*, Ex-1005, 12:10–27; *see also* Ex-1006, 20 (explaining the "intra-RAT measurement reporting in LTE").

[72] *See, e.g.*, Ex-1005, Fig. 19; Ex-1006, 343, 62 (Fig. 19).

[73] *See, e.g.*, Ex-1005, 14:21–28.

handover procedure "towards the at least one pico, or the another macro, node or cell."[74] This discloses that the handover request is for aggregating a cell.

79. Centonza also explains that a selective handover of bearers to a cell (*e.g.*, Secondary Cell "B") is for aggregating the cell for the time the UE stays in the cell (*i.e.*, the time until there are no bearers within the concerned cell and the UE context is released).[75]

TABLE 5

User equipment history, selective handovers implicitly indicated via time-stamping.

Cell ID	Cell Type	Time UE started connection in a cell	Time UE stayed in a cell
A	Type 1	t1	t4-t1
B	Type 2	t2	t3-t2

[74] *See, e.g.*, Ex-1006, 62 (Fig. 19); *id.*, 48, 66, 70 (disclosing handover "towards the pico node or cell"); *id.,* 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same); *id.*, Fig. 19.

[75] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

80. The above table shows, as detailed in Centonza, that the UE (such as a mobile phone) first connects to Cell A at time t1.[76] Then, the base station associated with Cell A receives request to handover a subset of the bearers to the base station associated with Cell B.[77] That request is for aggregation of Cell B with the subset of bearers to be handed over from Cell A.[78] Then, at time t2, the subset of bearers to be handed over are now in Cell B.[79] The above table shows that from time t2 to t3, the UE has dual connectivity, *i.e.*, it is connected to Cell A for one subset of

[76] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

[77] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

[78] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

[79] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

bearers and is connected to Cell B for another subset of bearers.[80] Then, at time t3, all of the bearers handed over to Cell B are handed back over to Cell A.[81] Then, at time t4, all of the bearers are handed over from Cell A to Cell C.[82]

81. Centonza explains that Cell A and Cell B can be "Anchor" Cells (which is a type of primary cell) or "Assisting" Cells (which is a type of secondary cell), showing a selective handover for aggregating a Secondary Cell (SCell) for a User Equipment (*e.g.*, aggregating the bearers in the Anchor Cell).[83]

[80] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

[81] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

[82] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

[83] *See, e.g.*, Ex-1006, 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same).

TABLE 7

User equipment history, selective handovers and eNB roles indicated explicitly.

Cell ID	Cell Type	Handover type	Cell Role	Time UE stayed in a cell
A	Type 1	Selective	Anchor	t2-t1
B	Type 2	Selective	Assisting	t3-t2
A	Type 1	Selective	Anchor	t4-t3

82. These examples reflect that, as disclosed in Centonza, the selective handover request received by the Target Base Station (the first eNB) from the Source Base Station (the second eNB) is a request for aggregating a SCell for a UE, *e.g.*, a request for aggregating an "Assisting" Cell B for a UE as shown above.

83. Again, Centonza discloses macro cells and pico cells (an anchor cell and a booster/assisting cell), including as a "Primary serving cell" (a PCell) and a "secondary cell" (an SCell).[84] Thus, the Source eNB controls a PCell (*e.g.*, an anchor cell) and the Target eNB controls an SCell (*e.g.*, an assisting cell).[85]

[84] *See, e.g.*, Ex-1005, Figs. 8–12, 12:10–27; Ex-1006, 14–18, 20, 144.

[85] *See, e.g.*, Ex-1005, Figs. 8–12, 12:10–27; Ex-1006, 14–18, 20, 144.

84. The Handover Request includes a target cell identifier (the "Target Cell ID") for an SCell as well as a list of the sub-set of radio bearers (called E-RABs[86]) to handover in an "E-RABs To Be Setup List."[87]

[86] "E-RAB" is short for "E-UTRAN Radio Access Bearer," and the E-RABs handed over include data radio bearers. Ex-1006, 47 ("[U]nless otherwise specified, by bearer it is meant a data radio bearer."); *id.*, 11, 47, 49, 51; Ex-1005, 4:13, 16:36–40, 17:5–18:24, 21:56–65, 27:56–58, 30:27–30.

[87] *See, e.g.*, Ex-1006, 50; Ex-1005, 17:5–18:24.

X2 HANDOVER REQUEST message	
	Presence
IE/Group Name	
Message Type	M
Old eNB UE X2AP ID	M
Cause	M
Target Cell ID	M
GUMMEI	M
UE Context Information	
>MME UE S1AP ID	M
>UE Security Capabilities	M
>AS Security Information	M
>UE Aggregate Maximum Bit Rate	M
>Subscriber Profile ID for RAT/Frequency priority	O
>E-RABs To Be Setup List	
>>E-RABs To Be Setup Item	
>>>E-RAB ID	M
>>>E-RAB Level QoS Parameters	M
>>>DL Forwarding	O
>>>UL GTP Tunnel Endpoint	M
>RRC Context	M
>Handover Restriction List	O
>Location Reporting Information	O
>Management Based MDT Allowed	O
UE History Information	M
Trace Activation	O
SRVCC Operation Possible	O
CSG Membership Status	O

85. This disclosure further shows that the Handover Request includes a request for aggregating a SCell of a UE, namely by requesting to handover a subset

of bearers (in the E-RABs To Be Setup List) "towards" a target cell, as I describe above.[88]

86. Thus, for the reasons above, it my opinion that Centonza, including as disclosed in the Centonza Provisional, teaches this limitation.

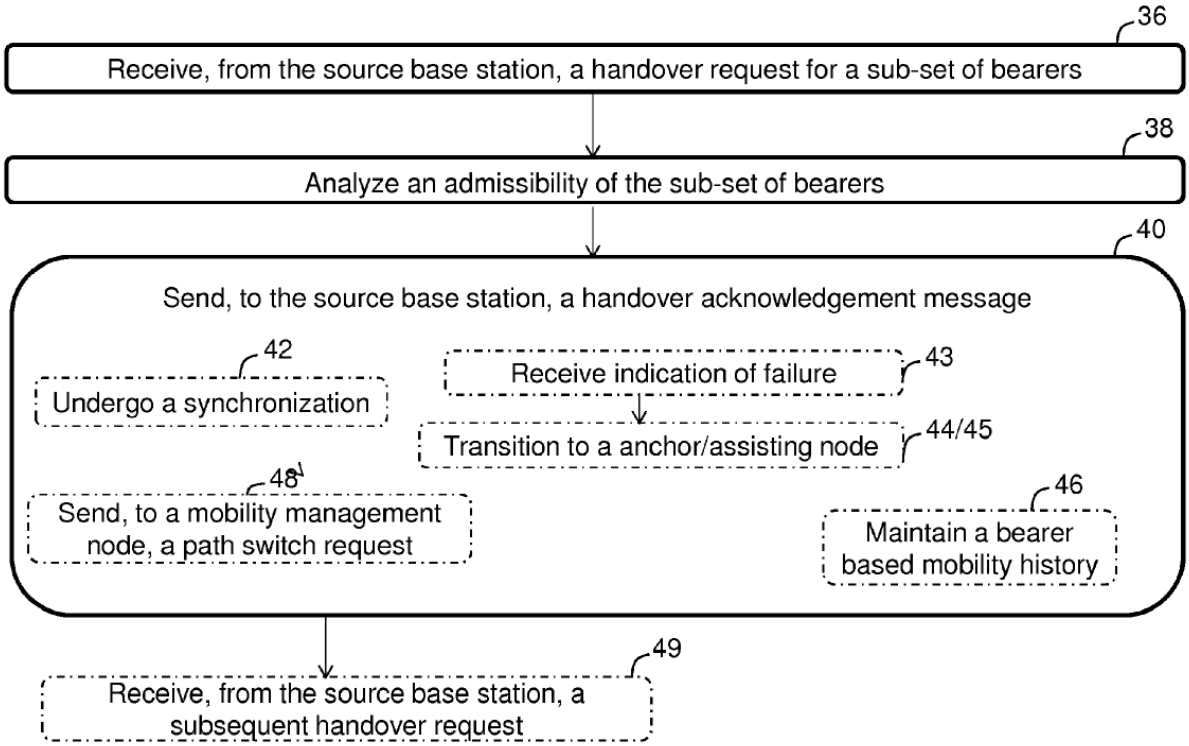
c) [1c]: transmitting an accept message from the first eNB to the second eNB in response to the first request; and

87. Centonza, including as disclosed in the Centonza Provisional, teaches transmitting an accept message from the first eNB (*e.g.*, the Target Base Station) to the second eNB (*e.g.*, the Source Base Station) in response to the first request.

88. Centonza, including as detailed in the Centonza Provisional, discloses that the Target Base Station "[s]ends, to the source base station, a handover acknowledgement message" in step 40 of Figure 19.[89]

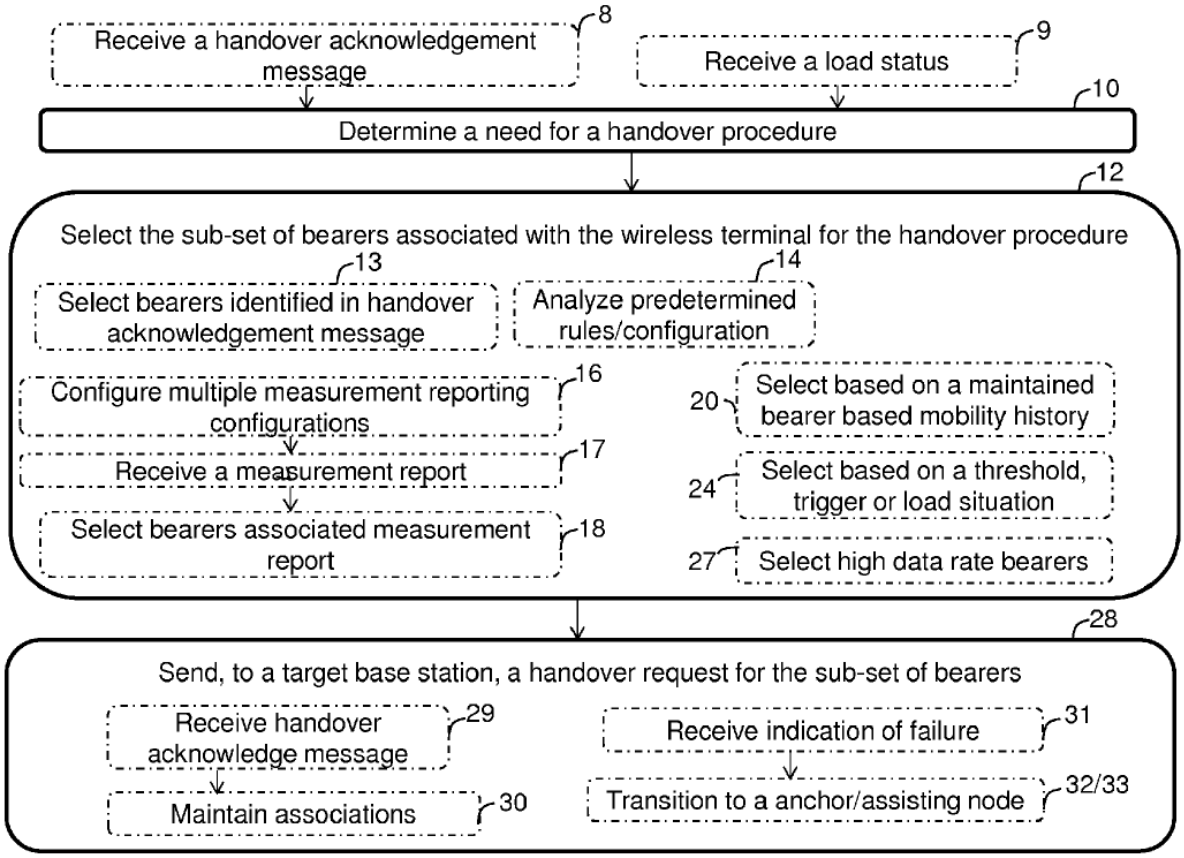
[88] *See, e.g.*, Ex-1006, 62 (Fig. 19); *id.*, 48, 66, 70 (disclosing handover "towards the pico node or cell"); *id.,* 52–54 (teaching selective handover from Anchor Cell A to Assisting Cell B); Ex-1005, 19:25–21:54 (same); *id.*, Fig. 19.

[89] *See, e.g.*, Ex-1005, Fig. 19; Ex-1006, 62 (Fig. 19).



89. Centonza explains that the Target Base Station is configured to send the handover acknowledgement message that contains the result of analyzing the admissibility of the subset of bearers (shown in step 38 in Figure 19 above), *e.g.*, the "admissibility for each bearer of the sub-set of bearers with respect to the handover procedure." The reference discloses that the Source Base Station then "[r]eceive[s] a handover acknowledgement message" in Figure 18 of Centonza (step 29).[90]

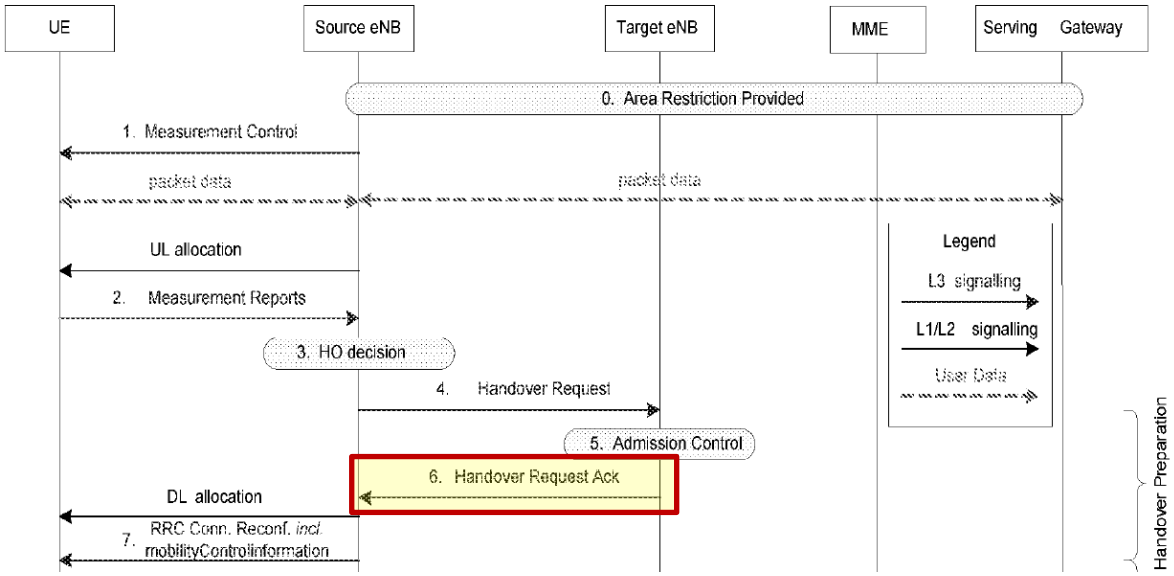
[90] *See, e.g.*, Ex-1005, Fig. 18; Ex-1006, 61 (Fig. 18).



90. Centonza explains that the Source Base Station "may be configured to receive 29, from the target base station 401B, an acknowledgement message with respect to the handover procedure for the sub-set of bearers. The acknowledgement message may comprise a result of the handover procedure for each bearer of the sub-set of bearers."[91]

[91] *See, e.g.*, Ex-1005, 27:64–28:6.

91. The figure below from Centonza (below is step 6 of the Figure 14 of the Centonza Provisional, which is depicted in Figure 15 of Centonza) shows the acknowledgement, which is an accept message (it acknowledges and accepts the handover request because it may admit one or more of the data radio bearers in the request).[92]



92. Centonza explains that, "when the target eNB receives a HANDOVER REQUEST message, it performs admission control and if it may admit one or more of the data radio bearers comprised in the request, it sends a HANDOVER

[92] *See, e.g.*, Ex-1006, 46 (Fig. 14); Ex-1005, Fig. 15.

REQUEST ACKNOWLEDGE message over X2 towards the source eNB,"[93] the format of which is detailed below (in the X2 HANDOVER REQUEST ACKNOWLEDGEMENT message) in TABLE 8.[94]

[93] *See, e.g.*, Ex-1005, 21:56–61; Ex-1006, 209 ("Admission Control may be performed by the target eNB.").

[94] *See, e.g.*, Ex-1005, 22:2–18; *see also id.*, 22:38–59 ("According to some of the example embodiments, the source eNB sends out a full handover request (legacy HO) and when it gets a HANDOVER REQUEST ACKNOWLEDGE where there are some entries in the E-RABs Not Admitted List, will change the full handover request to selective handover (if it knows that the target accepts selective handovers). This may be done in several ways. For example, the source eNB explicitly cancels the handover request by sending an X2 HANDOVER CANCEL command with a cause value of "partial Handover" towards the target followed by a selective HANDOVER REQUEST that comprises only the bearers that the target was able to admit in the handover that was just cancelled. As another example, the source may implicitly notify the change of the handover from full to selective by sending an X2 HANDOVER REQUEST message. As a further example, the source eNB may send a new X2 message, for example, HANDOVER REQUEST UPDATE, towards the

X2 HANDOVER REQUEST ACKNOWLEDGE message	
	Presence
IE/Group Name	
Message Type	M
Old eNB UE X2AP ID	M
New eNB UE X2AP ID	M
E-RABs Admitted List	
> E-RABs Admitted Item	
>> E-RAB ID	M
>> UL GTP Tunnel Endpoint	O
>> DL GTP Tunnel Endpoint	O
E-RABs Not Admitted List	O
Target eNB To Source eNB Transparent Container	M
Criticality Diagnostics	O

93. As detailed above and further in the message, the X2 HANDOVER REQUEST ACKKNOWLEDGE message includes a list of admitted bearers (the E-RABs Admitted List that contains Admitted Items) and, optionally, a list of bearers that were not admitted. These fields, in addition to providing a request to change

target that tells it to change the previous handover request from full to selective. Any messages sent by the source eNB may be sent with a selective handover IE set and with the list of the bearers that the target was able to admit."); Ex-1006, 55.

the data path, are further evidence that the message is an accept message, as the Target Base Station has admitted the bearers on the admitted list.

94. Centonza, including as disclosed in the Centonza Provisional, teaches that the handover acknowledgement message that the Target Base Station sends is in response the first request (*e.g.*, the handover request for a subset of bearers sent from the Source Base Station to the Target Base Station). Thus, for the reasons above, it my opinion that Centonza, including as disclosed in the Centonza Provisional, teaches this limitation.

> *d) [1d]: transmitting a second request from the first eNB, which controls the SCell of the UE, to the second eNB, which controls a Primary Cell (PCell) of the UE, to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE;*

95. Centonza, including as disclosed in the Centonza Provisional, teaches that the first eNB (the Target Base Station), which controls the SCell of the UE, transmits a second request to the second eNB (the Source Base Station), which controls a PCell of the UE. This request is to change the data path for a first radio bearer of the UE and the request does not indicate to change the data path for a third radio bearer of the UE.

96. Centonza discloses this request element. To the extent Centonza does not disclose the element, it would have been obvious to one of skill in the art to arrive at the claimed invention for the reasons explained below.

97. Centonza, including as detailed in the Centonza Provisional, teaches a first eNB (the Target eNB) that controls the SCell of the UE. As detailed above, the Target eNB controls an assisting (or pico) cell of the UE, which is a SCell of the UE. The Source eNB controls the anchor (or macro) cell of the UE, which is a PCell of the UE. This is the same disclosure as the '883 'patent, which explains that the "[t]he PCell could be a macro cell, and the SCell could be a small cell."[95]

98. Centonza, including as detailed in the Centonza Provisional, details that the first eNB (the Target eNB) transmits a second request to the second eNB (the Source eNB) to change a data path for a first radio bearer of the UE (*e.g.*, the data path for a radio bearer that is handed over). This request does not indicate to change the data path for a third radio bearer of the UE (*e.g.*, the data path for a radio bearer that is not handed over).

99. Centonza explains that the number of bearers that are handed over is "less than or equal to a total number of bearers associated with the wireless

[95] *See, e.g.*, Ex-1001, 6:66–67.

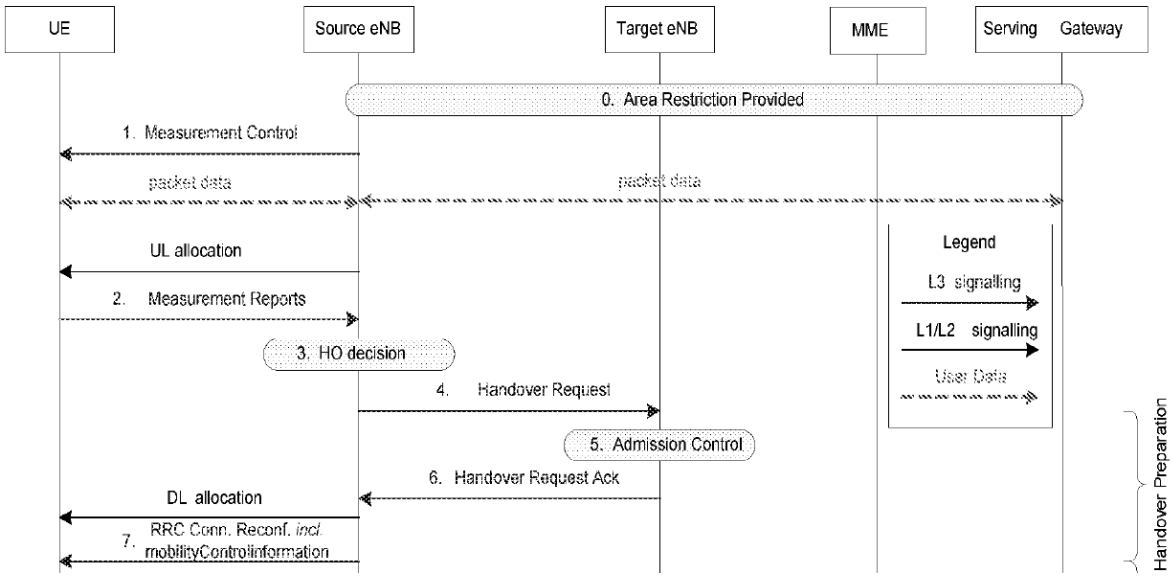
terminal," *i.e.*, at least one bearer is not handed over (and there is no request to change the data path for that third radio bearer).[96]

100. Centonza, including as detailed in the Centonza Provisional, discloses this "second request" claim element in multiple places. Each of these requests occur after the first request.

101. The first disclosure is as part of the Handover Request Acknowledge message that the Target eNB sends the Source eNB, as depicted below in the truncated Figure 14 from the Centonza Provisional (step 6), which is also Figure 15 of Centonza.[97]

[96] Ex-1005, 3:7–8; *id.*, 29:2–5 (describing a handover request "for a sub-set of bearers, wherein at least one bearer of the wireless terminal is to remain connected to the source base station"); Ex-1006, 106 (explaining that "at least one bearer (which is not associated with the identified sub-set) remains connected to the base station" as part of handover procedure); *id.*, 112 (explaining that at least one bearer "remains connected to the base station"). As detailed above (¶ 71), a POSITA would have understood that there were at least 11 data radio bearers for a UE in the LTE-based partial handover system that Centonza describes (and potentially up to 256).

[97] *See, e.g.*, Ex-1006, 46 (Fig. 14); Ex-1005, Fig. 15.



102. The Target eNB sends the Handover Request Acknowledge message over the X2 interface to the Source eNB. For the selective handover techniques described in Centonza, the Handover Request Acknowledge message contains a request to the Source eNB to handover the bearers listed in the Admitted List and then keep the bearers listed in the Not Admitted List.[98]

> According to some of the example embodiments, when a HANDOVER REQUEST ACKNOWLEDGE message that comprises some entries in the E-RABs Not Admitted List is received, the source eNB decides to keep those bearers with itself and hand over only the ones listed in the E-RABs Admitted List.

103. This reflects that the Handover Request Acknowledge message is a request to change a data path for a first radio bearer of the User Equipment (*e.g.*,

[98] *See, e.g.*, Ex-1005, 22:19–25; Ex-1006, 55–56.

change the data path for one of the bearers listed in the E-RAB Admitted List). The request also not indicate to change the data path for a third radio bearer of the User Equipment. Only the bears in the E-RABs Admitted List are to have their data paths changed; the bearers in the E-RABs Not Admitted List remain with the Source eNB.

104. At the time of this message, the Source eNB controls the PCell of the UE and Target eNB controls the SCell of the UE. The message is a request to change the data path for a first radio bearer of the UE (*e.g.*, to selectively handover a subset of bearers) and it does not indicate to change the data path for a third radio bearer of the UE. As detailed above, the Handover Request Acknowledge message includes a list radio bearers to handover (the "E-RABs Admitted List"). The request to change the data path for a first bearer (and to not change the data path for a third bearer) are reflected in the E-RABs Admitted List and an E-RABs Not Admitted List.[99]

[99] *See, e.g.*, Ex-1006, 55; Ex-1005, 22:1–8.

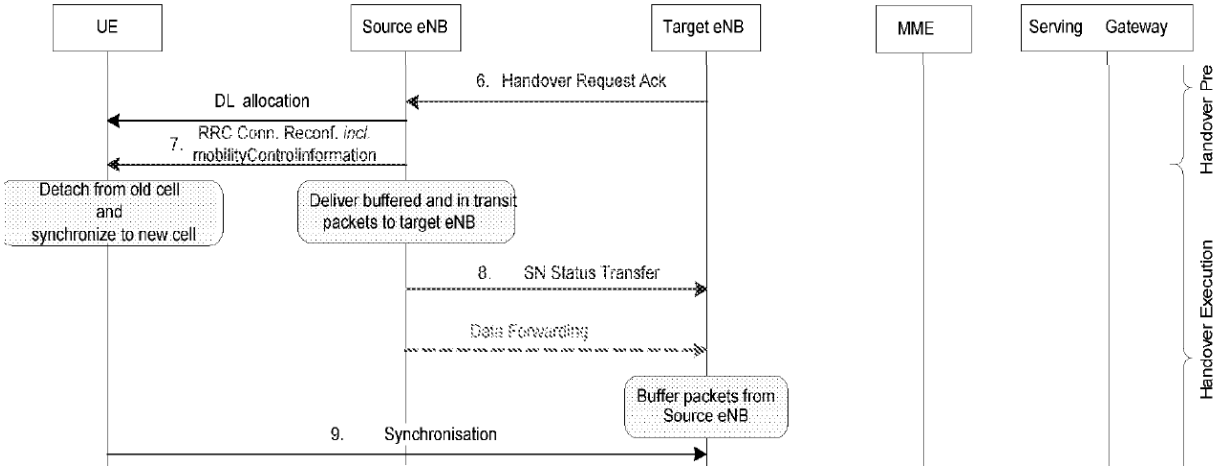
TABLE 8

X2 HANDOVER REQUEST ACKNOWLEDGE message	
	Presence
IE/Group Name	
Message Type	M
Old eNB UE X2AP ID	M
New eNB UE X2AP ID	M
E-RABs Admitted List	
> E-RABs Admitted Item	
>> E-RAB ID	M
>> UL GTP Tunnel Endpoint	O
>> DL GTP Tunnel Endpoint	O
E-RABs Not Admitted List	O
Target eNB To Source eNB Transparent Container	M
Criticality Diagnostics	O

105. The Source eNB receives these lists and changes the data path of radio bearers based on the lists, as detailed above: "the source eNB decides to keep those bearers [on the Not Admitted List] with itself and hand over only the ones listed in the E-RABs Admitted List."[100] Centonza shows the data-path change in the steps after receipt of the Handover Request Acknowledge, including the downlink ("DL")

[100] *See, e.g.*, Ex-1006, 55; Ex-1005, 22:19–25.

allocation, detaching from the old cell and synchronizing to the new cell, and forwarding packets to the Target eNB.[101]



106. This process changes the data path for the handed-over bearers and, correspondingly, the Handover Request Acknowledge requests to change the data path via the E-RABs Admitted List, including as detailed above. While the Source eNB releases its resources later in the process, the Handover Request

[101] *See, e.g.*, Ex-1006, 46 (Fig. 14); *id.*, 93 (teaching that "user plan data forwarding may be initiated" upon receipt of Handover Request Acknowledge); Ex-1005, Fig. 15; *id.,* 13:42–44 ("DL data arriving at the source eNB for the user equipment are then forwarded to the new target eNB.").

Acknowledgement requests to change the data path for the provided E-RABs (which the Source eNB then fulfills).[102]

107. Centonza explains that, in addition to providing an acceptance, the Handover Request Acknowledge message contains a request from the Target eNB to the Source eNB to change a data path for a first radio bearer of the User Equipment. As detailed above, the Handover Request Acknowledge message can contain the admissibility for each bearer of the subset of bearers with respect to the partial handover. If the handover is not a full handover of the bearers, the Source Base station will maintain "the association with a bearer which was not successfully handed over," which prevents "dropping of the bearer."[103] The Source eNB may also use the Handover Request Acknowledge message to "initiate a selective handover for a sub-set of bearers," which can include "the bearers which have been

[102] *See, e.g.*, Ex-1005, 30:13–18 (explaining that bearers "were successfully handed over" prior to the Path Switch Request); Ex-1006, 94 (teaching that "target eNB can begin sending data to the UE and the UE can send data to the target based on the scheduling grants it is receiving" after the Handover Request Acknowledge and the Path Switch Request "inform[s] that the UE has changed cell").

[103] *See, e.g.*, Ex-1005, 28:8–18; Ex-1006, 33 (Fig. 18B), 43, 45.

indicated in the acknowledgement message as being capable of being handed over."[104]

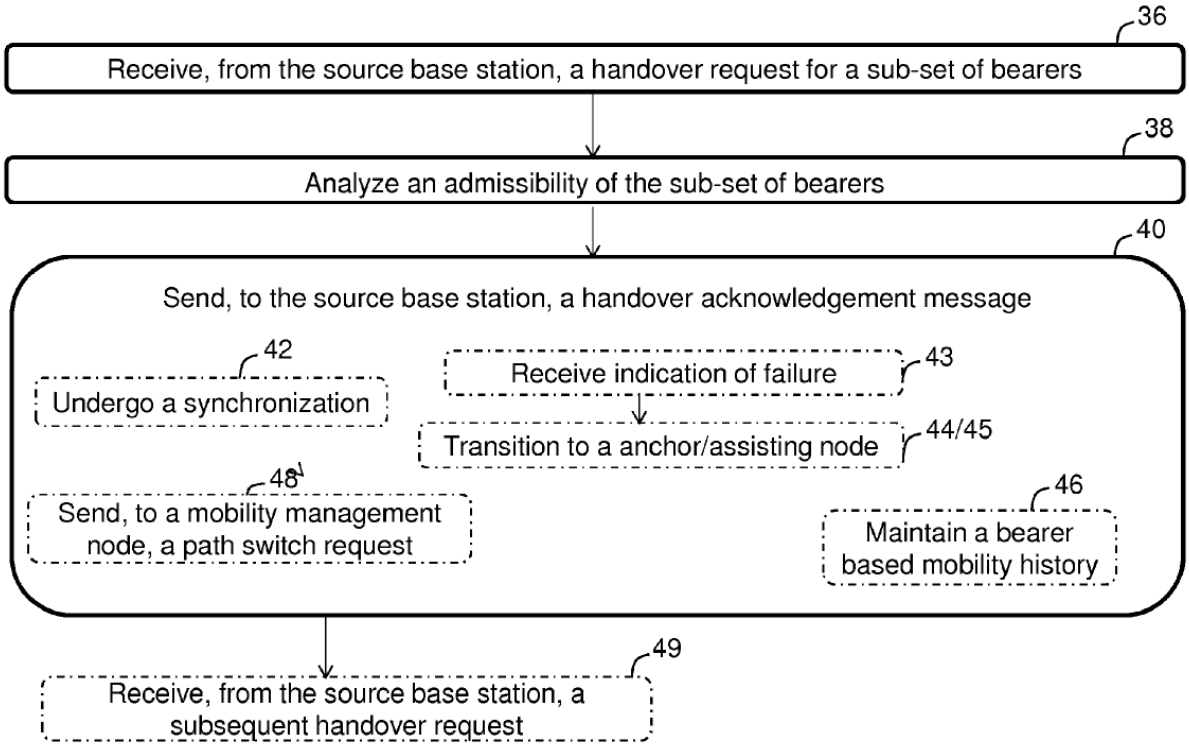
108. Centonza teaches that "when an X2 HANDOVER REQUEST ACKNOWLEDGE message is received, the source eNB decides to handover only a sub set of the admitted bearers and keep the rest with itself. This may be communicated in several ways as above, for example, by explicitly canceling the handover followed by a new request, sending a request that will invalidate the previous one, or sending a new X2 message (e.g. HANDOVER REQUEST UPDATE)."[105] The Handover Request Acknowledge message, in my opinion, meets this claim element.

109. The second message that meets the "second request" limitation is the Path Switch Request to UE Context Release. Centonza, including as detailed in the Centonza Provisional, discloses that the Target Base Station "[s]ends, to a mobility management node, a path switch request" in step 48 of Figure 19, which contains "an identity of the sub-set of bearers which were successfully handed over."[106]

[104] *See, e.g.*, Ex-1005, 26:4–8.

[105] *See, e.g.*, Ex-1005, 23:7–15; Ex-1006, 56.

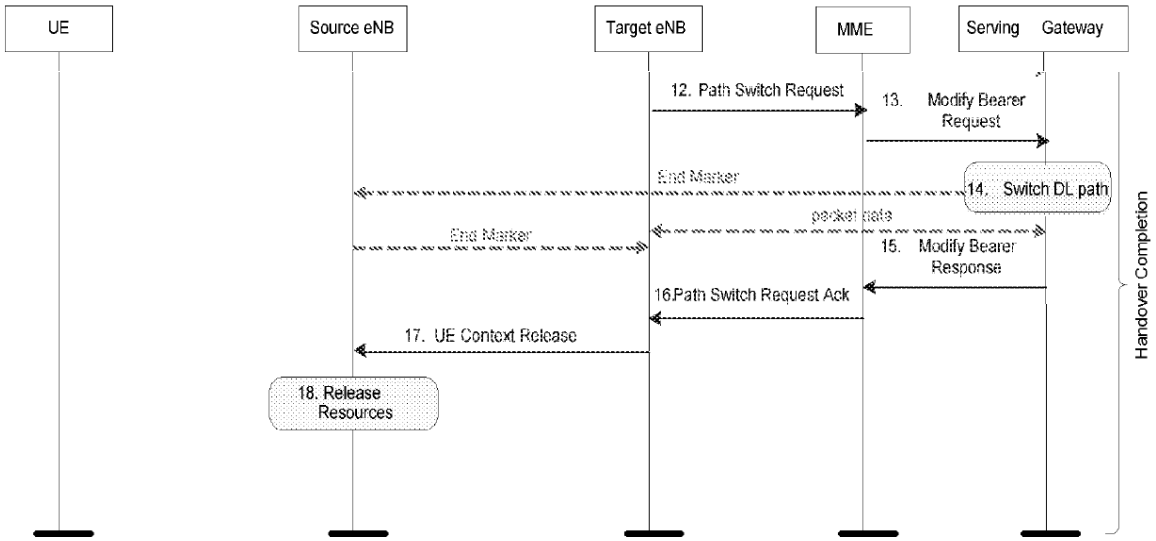
[106] *See, e.g.*, Ex-1005, Fig. 19; Ex-1006, 34, 62 (Fig. 19).



110. The Source eNB likewise receives this message, as detailed below.

111. The message originates from the Target eNB (at step 12 below), propagates through the core network (the MME and SGW), and results in the Source eNB releasing the resources (step 18).[107]

[107] *See, e.g.*, Ex-1006, 46 (Fig. 14); Ex-1005, Fig. 15.



112. The Path Switch Request "indicat[es] switching of bearers listed in X2: HANDOVER REQUEST message."[108] The request also includes a list of E-RABs handed over (reflected in the highlighted "E-RAB To Be Switched in Downlink List").[109]

[108] *See, e.g.*, Ex-1006, 51; Ex-1005, 18:14–19.

[109] *See, e.g.*, Ex-1005, 18:48–19:23; Ex-1006, 52.

TABLE 1a

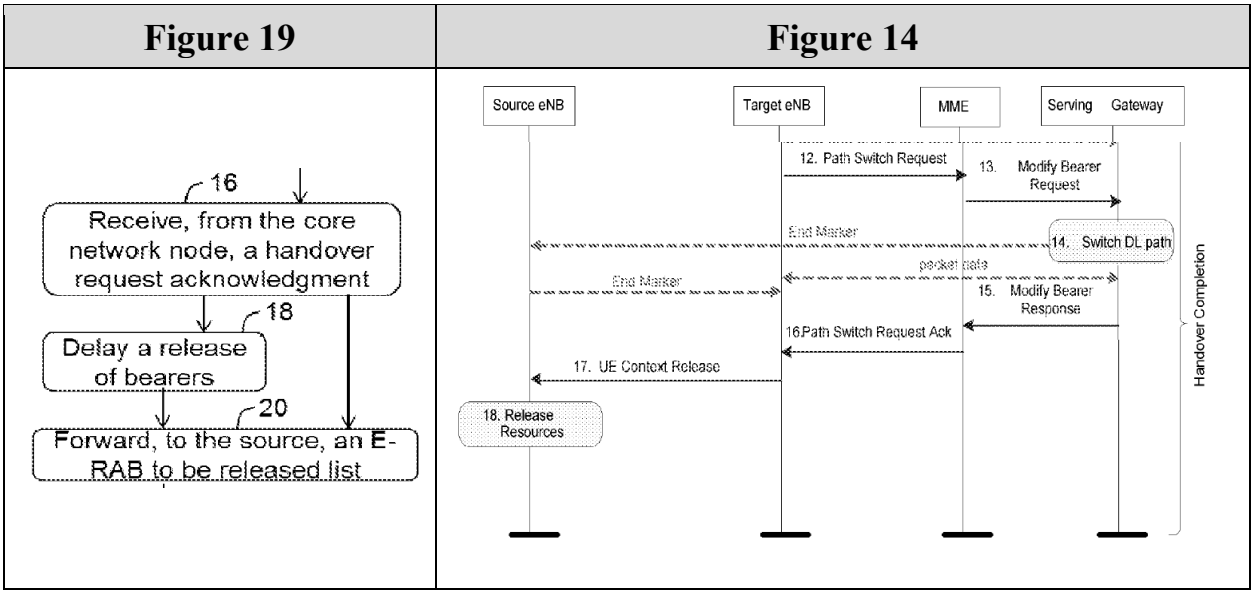
PATH SWITCH REQUEST message					
IE/Group Name	Presence	Range	Semantics description	Criticality	Assigned Criticality
Message Type	M			YES	reject
eNB UE S1AP ID	M			YES	reject
E-RAB To Be Switched in Downlink List		1		YES	reject
>E-RABs Switched in Downlink Item IEs		1 to <maxnoof E-RABs>		EACH	reject
>>E-RAB ID	M			—	
>>Transport layer address	M			—	
>>GTP-TEID	M		To deliver DL PDUs	—	

113. Centonza teaches that, in the case of selective handover (through the Selective Handover Indicator), that any bearers that are not listed in the Path Switch Request "shall not be dropped."[110] At the time of this message, the Source eNB controls the PCell of the UE and Target eNB controls the SCell of the UE. The message is a request to change the data path for a first radio bearer of the UE (*e.g.*, to selectively handover a subset of bearers) and it does not indicate to change the data path for a third radio bearer of the UE (*e.g.*, at least one of the bearers that is

[110] *See, e.g.*, Ex-1005, 18:32–34; Ex-1006, 51; *id.*, 26 (including in the Path Switch Request a list of "bearers that are to be kept at the source").

not handed over). As detailed above, the Path Switch Request includes a list radio bearers handed over (the "E-RABs To Be Switched in Downlink List").

114. After sending the Path Switch Request, the Target eNB forwards to the Source eNB a list of bearers to release (UE Context Release), which triggers the Source eNB's release of radio and control-plane related resources (step 18 in Fig. 14).[111]



115. Step 12 teaches the Path Switch Request, followed by a Modify Bearer Request (step 13) to the Serving Gateway (also known as the "SGW"), followed by the action at the SGW to switch the downlink path (step 14), followed by the Modify

[111] *See, e.g.*, Ex-1006, 46 (Fig. 14), 34 (Fig. 19), 94, 158; Ex-1005, Fig. 15, Fig. 19, 19:64–20:8.

Bearer Response (step 15), a Path Switch Request Acknowledgement (step 16), and the UE Context Release (step 17). The Centonza Provisional explains that "[b]y sending the UE CONTEXT RELEASE message, the target eNB informs success" of the handover to the Source eNB and "triggers the release of resources by the source eNB."[112] The Source eNB, after receiving the UE Context Release, release the "resources associated with those bearers that have been selectively handed over."[113]

> In legacy LTE handover, after the completion of the handover at the target (i.e. the target gets the PATH SWITCH REQUEST ACK message from the MME), the target notifies this to the source by sending the UE Context Release message. When the source gets this message, it may release radio and control plane related resources associated to the UE context. However, with regard to selective handover, this might not be needed as some of the bearers of the UE might still be kept at the source.
>
> According to some of the example embodiments, the source eNB, upon the reception of the context release message, will release only the resources associated with those bearers that have been selectively handed over.

[112] *See, e.g.*, Ex-1006, 211; *id.*, 46 (Fig. 14), 34 (Fig. 19), 94, 158, 211; Ex-1005, Fig. 15, Fig. 19, 19:64–20:8.

[113] *See, e.g.*, Ex-1006, 158; *see also* Ex-1005, 13:45–54, 19:64–20:28 (similar).

116. While the core network is involved in switching the downlink path (step 14 above), the Source eNB changes the data path and releases resources based on messages received from the Target eNB (Handover Request Acknowledgement and Path Switch Request to UE Context Release).

117. After sending the Path Switch Request, the Target eNB receives an acknowledgement from the core network and forwards, to the Source eNB, a list of bearers to be released.[114]

[114] *See, e.g.*, Ex-1006, 34 (Fig. 19); Ex-1005, Fig. 19 (similar).

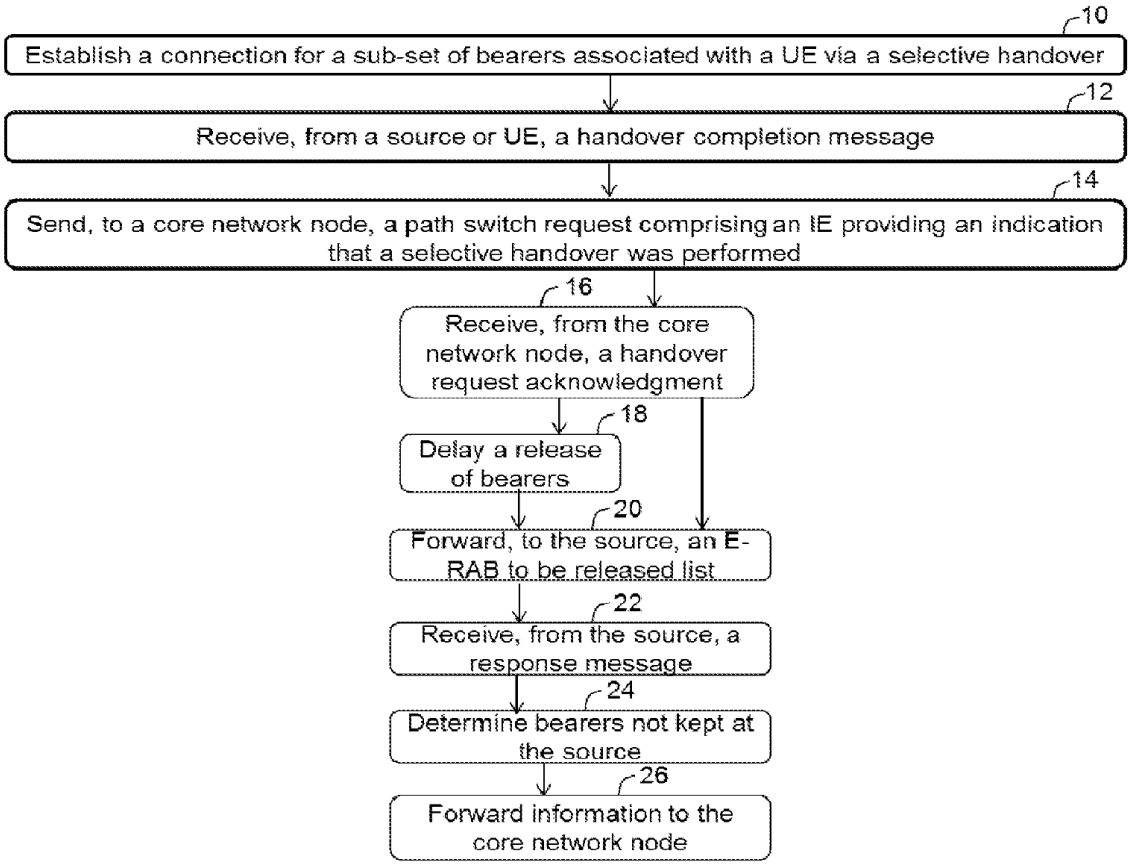


Figure 19 – example operations of a target base station

118. The Centonza Provisional explains that "the source eNB, upon reception of the context release message, will release only the resources associated with those bearers that have been selectively handed over."[115] Centonza similarly teaches that "[a]fter a proper setup of the connection with the target eNB is performed (which comprises the switching of the DL path in the serving gateway), the old connection is released and any remaining data in the source eNB that is

[115] *See, e.g.*, Ex-1006, 158.

destined for the user equipment is forwarded to the target eNB. Then normal packet flow may ensue through the target eNB."[116]

119. Moreover, the Path Switch Request to UE Context Release is a request from the Target eNB to the Source eNB that flows through the core network (over S1) and to the Source eNB (over X2). It is a request from the Target eNB to the Source eNB. The core network devices, such as the MME and SGW, act as a conduit for the message. They forward the request from Target eNB to the Source eNB, which ultimately results the Source eNB releasing its resources in Step 18 for the bearers identified in the E-RAB To Be Switched in Downlink List. A POSITA would thus have understood the Path Switch Request to UE Context Release message to be a request from the Target eNB to the Source eNB, even though it is delivered through the core network (S1 interface) and the X2 interface. Indeed, the '883 patent discloses both sending the path switch request directly to the eNB or through the core network, which indicates to a POSITA that the '883 claims could cover both scenarios.

120. Centonza also discloses, in the context of subsequent selective handovers, a second request transmitted from the first eNB (the Target eNB) to the second eNB (the Source eNB) to change a data path for a first radio bearer of the UE

[116] *See, e.g.*, Ex-1005, 13:45–54.

(the bearers subject to handing over back to the Source eNB for further processing such as requests from the assisting cell to the anchor cell).

121. Centonza explains that the assisting node (the "first eNB") sends the anchor node (the "second eNB") a Handover Request that "recommends the selective handover of these bearers to the new assisting node. The anchor may use the recommendation and may handover the bearers to the new assisting node or decide to keep it with itself or drop them."[117] The Handover Request includes a list radio bearers to handover (the "E-RABs To Be Setup List") as part of the message shown above for [1b].[118] This message also requests a data-path change because it requests handing over the bearers in the E-RABs To Be Setup List.

122. Centonza explains that the Target eNB sends the Source eNB a HANDOVER REQUEST message that "recommends the selective handover of these bearers to the new assisting node. The anchor may use the recommendation

[117] *See, e.g.*, Ex-1005, 23:54–61; Ex-1006, 56–57. .

[118] *See, e.g.*, Ex-1006, 50; Ex-1005, 17:5–18:24.

and may handover the bearers to the new assisting node or decide to keep it with itself or drop them."[119]

> According to some of the example embodiments, an eNB acting like an assisting node, to which some of the user equipment bearers have been selectively handed over to from the anchor eNB, may later on perform a selective handover of the user equipment to another assisting eNB. This may be performed in several ways. As an example, the old assisting node may hand over the bearers back to the anchor, with an indication (e.g., via a new IE in the X2 HANDOVER REQUEST message) that recommends the selective handover of these bearers to the new assisting node. The anchor may use the recommendation and may handover the bearers to the new assisting node or decide to keep it with itself or drop them.

123. At the time of this message, the Source eNB controls the PCell of the UE and Target eNB controls the SCell of the UE. The message is a request to change the data path for a first radio bearer of the UE (*e.g.*, to selectively handover a subset of bearers from the Source eNB to a new assisting node) and it does not indicate to change the data path for a third radio bearer of the UE. As detailed above, the Handover Request message includes a list radio bearers to handover (the "E-RABs To Be Setup List"), which "[f]or the case of selective handover, this list may also be

[119] *See, e.g.*, Ex-1005, 23:50–61; Ex-1006, 56–57 (discussing subsequent handovers).

used to cover the data radio bearers that the anchor wants to handover to the assisting cell. The rest of the E-RABs will remain at the source eNB."[120] This message is also one to change the data path the subset of bearers in the E-RABs To Be Setup List because it requests those bearers to be selective handed over, which changes the data path.

124. None of these messages (the Handover Request Acknowledge, the Handover Request message from the Target eNB in a Subsequent Selective Handover, and the message from the Path Switch Request to the UE Context Release) indicate to change the data path for a third radio bearer of the UE. The messages each contain a list of the radio bearers that are selectively handed over and whose data paths are changed. And they are sent from the Target eNB to the Source eNB (either directly, in the case of the Handover Request Acknowledge, Handover Request, and UE Context Release, or as transmitted from the Target eNB, propagated through the cellular network, and received by the Source eNB in the case of the Path Switch Request to the UE Context Release).

125. All of these messages are requests to change the data path of a radio bearer. The messages each contain a listing of radio bearers for which the Target eNB requests a change in the data path ("E-RABs To Be Setup" in the Handover

[120] *See, e.g.*, Ex-1005, 18:9–25; Ex-1006, 51.

Request message, the E-RABs Admitted" in the Handover Request Acknowledge message, and the "E-RABs Switched in Downlink" in the Path Switch Request message). In the case of the UE Context Release, the message causes the Source eNB to release the resources associated with the subset of bearers handed over.

126. The Target eNB (the "first eNB") controls the SCell of the UE and the Source eNB (the "second eNB") controls a PCell of the UE, including at the time of the second requests identified above. As detailed above, the Target eNB controls an SCell of the UE (*e.g.*, an assisting or pico cell) and the Source eNB controls a PCell of the UE (*e.g.*, the anchor or macro cell) of the UE.[121]

127. The identified "second requests" are to change a data path for a first radio bearer (*e.g.*, the data path for bearer handed over) but do not indicate to change the data path for a third radio bearer of the UE (*e.g.*, the data path for a radio bearer that is not handed over). Centonza explains that the number of bearers that are handed over is "less than or equal to a total number of bearers associated with the wireless terminal," *i.e.*, at least one bearer is not handed over (and there is no request

[121] *See, e.g.*, Ex-1001, 6:66–67 ('883 patent explaining that "[t]he PCell could be a macro cell, and the SCell could be a small cell").

to change the data path for that third radio bearer).[122] The Handover Request Acknowledge and Path Switch Request state that there are bearers that will not be handed over, the E-RABs Not Admitted List and the Selective Handover Indicator, respectively, reinforcing that the request does not indicate a change in data path for a third radio bearer.[123]

128. Thus, in my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this claim limitation.

[122] Ex-1005, 3:7–8; *id.*, 29:2–5 (describing a handover request "for a sub-set of bearers, wherein at least one bearer of the wireless terminal is to remain connected to the source base station"); Ex-1006, 106 (explaining that "at least one bearer (which is not associated with the identified sub-set) remains connected to the base station" as part of handover procedure); *id.*, 112 (explaining that at least one bearer "remains connected to the base station"). A POSITA would have understood that there were at least 11 data radio bearers for a UE in the LTE-based partial handover system that Centonza describes (and potentially up to 256), as detailed above.

[123] *See, e.g.*, Ex-1006, 52, 55; Ex-1005, 19:1–23, 22:1–18.

e) [1e]: wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.

129. Centonza, including as disclosed in the Centonza Provisional, teaches that the first path is via the first eNB (the Target eNB) and is used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.

130. Centonza teaches dual connectivity between a macro node and a pico node through the selective handover of bearers between nodes (both to and from each node).[124] When this occurs, a first and third radio bearer (*e.g.*, two of the up to 11+ E-RABs) utilize the same first data path prior to the handover of a first radio bearer (*e.g.*, one of the E-RABs), including bearers at the Target eNB (*e.g.*, the first

[124] *See, e.g.*, Ex-1005, 2:37–45; Ex-1006, 26, 28; Ex-1005, 21:49–61 ("[A]n eNB acting like an assisting node ... may later on perform a selective handover of the user equipment to another assisting eNB.... As an example, the old assisting node may hand over the bearers back to the anchor .... The anchor may use the recommendation and may handover the bearers to the new assisting node or decide to keep it with itself or drop them."); Ex-1006, 56–57, 101–102, 149 (similar).

data path is via the pico node for two E-RABs, and this path exists prior to the handover of an E-RAB to the macro node or another pico node).

131. Centonza discloses that, before changing the data path for the first radio bearer, the first radio bearer and third radio bearer utilize a data path via the Target eNB. Centonza discloses a mobile device that can use multiple flows, such as an anchor flow from the macro base station and an assisting flow from a pico base station.[125]

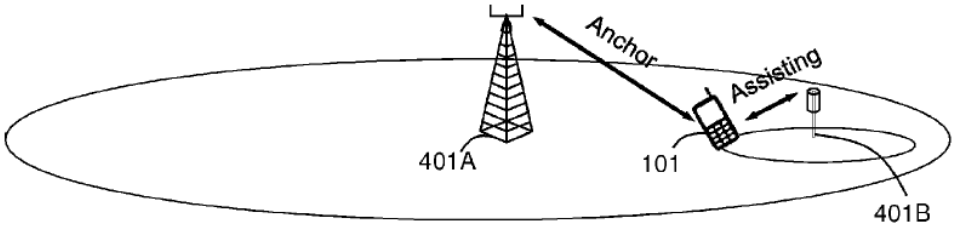


FIGURE 1

132. Centonza explains that it discloses "an optimized approach to handover that takes advantage of multiple connectivity of a user equipment to several eNBs, where the handover can be triggered and/or executed at a bearer level."[126] This approach "make[s] it possible to perform handovers selectively between a source

[125] *See, e.g.*, Ex-1005, Fig. 1; Ex-1006, Fig. 11.

[126] *See, e.g.*, Ex-1005, 14:7–20.

and a target eNB, thereby creating more system flexibility than the legacy way of performing handover where a user equipment is completely handed over to the target."[127] This makes it possible to "keep all the user equipment bearers ongoing as the bearers that the target was not able to admit may be kept at the source."[128] It also makes it possible to "trigger handover at a bearer level rather than at a user equipment level," which, for example, allows the Source eNB to "keep the bearers that can't tolerate discontinuity such as VoIP services with itself until the radio conditions of the source are at much lower quality than the target, while bearers that are very capacity hungry but more tolerant to interruptions such as file download may be handed over to the target even if the radio conditions at the source are not that bad."[129]

133. During the handover process described in Centonza, "[a]fter a proper setup of the connection with the target eNB is performed (which comprises the switching of the DL path in the serving gateway), the old connection is released and

[127] *See, e.g.*, Ex-1005, 2:37–45.

[128] *See, e.g.*, Ex-1005, 2:37–45.

[129] *See, e.g.*, Ex-1005, 2:46–54.

any remaining data in the source eNB that is destined for the user equipment is forwarded to the target eNB. Then normal packet flow may ensue through the target eNB."[130] The Reference explains how the radio bearers are selectively handed over.[131]

> According to some of the example embodiments, a source eNB may decide to initiate the handover of the signaling radio bearers towards the target eNB. After the handover the target becomes the anchor node (the termination point for the control plane) and the source becomes the assisting node. The source eNB may also choose to comprise some data radio bearers in this handover request. That is, after the handover, the source might handle some data radio bearers of the user equipment, while the target will handle all the signaling radio bearers and the other data radio bearers.

134. Centonza similarly discloses subsequent selective handovers, in which the Target eNB provides a Handover Request message to the Source eNB to perform a selective handover of a subset of bearers back to the Source eNB (and potentially to a new eNB, like an assisting eNB).[132]

[130] *See, e.g.*, Ex-1005, 13:45–54.

[131] *See, e.g.*, Ex-1005, 13:45–54.

[132] *See, e.g.*, *See, e.g.*, Ex-1005, 21:49–61 ("[A]n eNB acting like an assisting node ... may later on perform a selective handover of the user equipment to another

> According to some of the example embodiments, when the source eNB selectively hands over the HANDOVER REQUEST ACKNOWLEDGE message, it keeps the mapping of the New eNB UE X2AP ID and Old eNB UE X2AP ID, so that if a HANDOVER REQUEST is received later on from the target eNB that has the same Old eNB UE X2AP ID as the New eNB UE X2AP ID saved in this mapping, it knows that it is a user equipment that is returning towards the anchor after being selectively handed over for some time.
>
> According to some of the example embodiments, an eNB acting like an assisting node, to which some of the user equipment bearers have been selectively handed over to from the anchor eNB, may later on perform a selective handover of the user equipment to another assisting eNB. This may be performed in several ways. As an example, the old assisting node may hand over the bearers back to the anchor, with an indication (e.g., via a new IE in the X2 HANDOVER REQUEST message) that recommends the selective handover of these bearers to the new assisting node. The anchor may use the recommendation and may handover the bearers to the new assisting node or decide to keep it with itself or drop them.

135. Centonza, as detailed above, changes the data path for a subset of bearers based on the E-RAB list entries in the messages detailed in in the limitation

assisting eNB.... As an example, the old assisting node may hand over the bearers back to the anchor .... The anchor may use the recommendation and may handover the bearers to the new assisting node or decide to keep it with itself or drop them.”); Ex-1006, 56–57 (similar).

above (*e.g.*, the Handover Request message, the Handover Acknowledgment message, and the Path Switch Request through UE Context Release message). The Reference explains that "[f]or the case of selective handover, this list may also be used to cover the data radio bearers that the anchor wants to handover to the assisting cell. The rest of the E-RABs will remain at the source eNB."[133] As detailed above, those of ordinary skill in the art would understand that the number of bearers for a UE could be as high as 11 (and potentially up to 256).

136. These disclosures show that Centonza teaches that a first path is via the first eNB (the Target eNB), namely the data path for the E-RABs (the first and third radio bearers) for the Target eNB before the selective handover of the first radio bearer (in the E-RAB list entries detailed above) to the Source eNB.

3) Claim 2

a) [Preamble]: The method of claim 1, wherein

137. In my opinion, for the reasons above, Centonza anticipates claim 1 of the '883 patent.

[133] *See, e.g.*, Ex-1005, 18:9–24; Ex-1006, 56–57 (similar).

b) [2b]: the data path for the first radio bearer is changed to a second path, wherein the second path is via the second eNB and used as a data path for a second radio bearer of the UE.

138. Centonza, in my opinion, discloses this claim element. Centonza discloses that the data path for the first radio bearer (*e.g.*, the data path for a bearer at the Target eNB) is changed to a second path via the second eNB (*e.g.*, the data path for a bearer at the Source eNB after the selective handover) and is used a data path for a second radio bearer of the UE (*e.g.*, a bearer at the Source eNB prior to the handover that remains at the Source eNB).

139. As I discuss in the section above, Centonza provides for selective handover of a subset of bearers, which changes the data path for the bearers selectively handed over (*e.g.*, in the E-RAB list) but does not change the data path for the bearers that are not handed over (*e.g.*, the bearers not in the E-RAB list or in the E-RABs Not Admitted List). These disclosures, in my opinion, teach that, when the data path of one radio bearer is changed from on eNB to another (such as from the Target eNB to the Source eNB) and the data path for another radio bearer remains unchanged (*e.g.*, a bearer that is not handed over), that the handed over bearer and the unchanged bearer use the same data path after the handover (*e.g.*, both use the

data path via the Source eNB).[134] I also incorporate my analysis and citations to Centonza from [1e] above. Thus, in my opinion, Centonza discloses this limitation.

4) Claim 3

a) [Preamble]: The method of claim 1, wherein

140. In my opinion, for the reasons above, Centonza anticipates claim 1 of the '883 patent.

b) [3b]: the second request includes a cause for data path changing.

141. In my opinion, Centonza explains that the second request (*e.g.*, the Handover Request, Handover Acknowledge, and Path Switch Request through UE Context Release) includes a cause for data path changing (*e.g.*, "a threshold, triggering event, a radio signal level, a buffer level of a bearer, and/or a load situation at the source and/or target base station").[135] Centonza explains that a triggering event may cause the eNB to "choose certain bearers (e.g. non GBR bearers) for the selective handover, and similarly, if the second report gets triggered, the eNB may

[134] *See, e.g.*, Ex-1005, Fig. 15, 13:45–54 (discussing switching of the downlink path); Ex-1006, 22, 46.

[135] *See, e.g.*, Ex-1006, 48; Ex-1005, 15:42–55.

choose other kind of bearers (e.g. GBR bearers) for the selective handover."[136] This cause for changing the data path is reflected in the second request, *e.g.*, in the "Cause" information element in the Handover Request, the Selective Handover Indicator in the Path Switch Request, and/or the Admitted/Not Admitted Lists in the Handover Request Acknowledge and Criticality Diagnostics.[137] Thus, in my opinion, Centonza discloses this claim element.

5) Claim 4

a) [Preamble]: The method of claim 1, wherein

142. In my opinion, for the reasons above, Centonza anticipates claim 1 of the '883 patent.

b) [4b]: the UE has multiple paths via different eNBs after the data path for the first radio bearer change.

143. In my opinion, Centonza discloses that the User Equipment (UE) has multiple paths via different eNBs after the data path for the first radio bearer change. Centonza, as detailed above, discloses that after the selective handover of a bearer, that the UE has multiple data paths via different eNBs, such as the data path via the Anchor eNB and the Assisting eNB.

[136] *See, e.g.*, Ex-1006, 48; Ex-1005, 15:42–55.

[137] *See, e.g.*, Ex-1005, 17:5–35, 19:1–25, 22: 1–17; Ex-1006, 50, 52, 55.

144. Centonza discloses that after the selective handover of a first radio bearer (*e.g.*, an E-RAB), the UE has multiple data paths via different eNBs, such as the data path via the Anchor eNB and the Assisting eNB.[138] Centonza explains that its disclosure "make it possible to perform handovers selectively between a source and a target eNB, thereby creating more system flexibility than the legacy way of performing handover where a user equipment is completely handed over to the target. At least one example advantage of some of the example embodiments presented herein is the possibility to keep all the user equipment bearers ongoing as the bearers that the target was not able to admit may be kept at the source."[139] Centonza explains, for example, that "the source eNB may keep the bearers that can't tolerate discontinuity such as VoIP services with itself until the radio conditions of the source are at much lower quality than the target, while bearers that are very capacity hungry but more tolerant to interruptions such as file download

[138] *See, e.g.*, Ex-1005, 2:55–60 (explaining that system can "maintain control plane at one eNB, while sharing the data load at several eNBs"); *id.*, 15, 13:45–54 (discussing switching of the downlink path); Ex-1006, 22 (same), 46 (Fig. 14), 58 (discussing "sharing the data load at several eNBs").

[139] *See, e.g.*, Ex-1005, 2:37–45; Ex-1006, 28, 102.

may be handed over to the target even if the radio conditions at the source are not that bad."[140]

145. Centonza explains that, using the system disclosed therein, it is possible to "maintain control plane at one eNB, while sharing the data load at several eNBs."[141] This is performed through "providing a handover for a sub-set of bearers associated with a wireless terminal being served by the source base station. The sub-set of bearers is less than or equal to all bearers associated with the wireless terminal. . . . The method further comprises sending, to a target base station, a handover request for the sub-set of bearers, wherein at least one bearer of the wireless terminal remains connected to the source base station."[142] Centonza further explains, in one embodiment, the macro nodes "are able to provide coverage" and the pico nodes "are there only for capacity enhancements (i.e., no coverage holes)."[143] The Reference provides another example in which "the user equipment maintains the

[140] *See, e.g.*, Ex-1005, 2:46–54; Ex-1006, 28, 102.

[141] *See, e.g.*, Ex-1005, 2:55–60; Ex-1006, 28, 102.

[142] *See, e.g.*, Ex-1005, 3:3–16.

[143] *See, e.g.*, Ex-1005, 10:28–43; Ex-1006, 17.

macro connectivity all the time (called the 'anchor' flow), and adds the pico connectivity when it is in the coverage area of the pico (called the 'assisting' flow)."[144] The Reference also explains that "[w]hen both connections are active, the anchor flow may be used either for control signaling while the assisting flow is used for data" but "it will still be possible to send data also via the anchor flow."[145]

146. These disclosures show that Equipment (UE) has multiple paths via different eNBs after the data path for the first radio bearer change, *e.g.*, one data path through the anchor node and another data path via the assisting node after the selective handover.

147. Thus, in my opinion, Centonza discloses this claim element.

6) Claim 5

a) [Preamble]: The method of claim 1, further comprising:

148. In my opinion, for the reasons above, Centonza anticipates claim 1 of the '883 patent.

[144] *See, e.g.*, Ex-1005, 10:28–43; Ex-1006, 17.

[145] *See, e.g.*, Ex-1005, 10:28–43; Ex-1006, 17.

b) [5b]: receiving, by the first eNB, a confirmation message from the second eNB for changing the data path for the first radio bearer.

149. In my opinion, Centonza discloses receiving, by the first eNB (*e.g.*, the Target eNB), a confirmation message from the second eNB (*e.g.*, the Source eNB) for changing the data path for the first radio bearer. Centonza discloses that the Target eNB receives a Handover Confirm message "once the target eNB and the user equipment are synchronized," and, "[a]fter a proper setup of the connection with the target eNB is performed (which comprises the switching of the DL path in the serving gateway), the old connection is released and any remaining data in the source eNB that is destined for the user equipment is forwarded to the target eNB."[146] This message is a confirmation message for changing the data path for the first radio bearer (*e.g.*, confirming that the bearer has been successfully handed over).[147]

[146] *See, e.g.*, Ex-1005, 13:45–55; Ex-1006, 22.

[147] Centonza teaches that the Target eNB then sends a message "comprising an identity of the sub-set of bearers which were successfully handed over" that ultimately propagates through the core network to ultimately release the bearers that were handed over. Ex-1005, 30:14–19.

7) Claim 6

a) [Preamble]: The method of claim 1, wherein

150. In my opinion, for the reasons above, Centonza anticipates claim 1 of the ’883 patent.

b) [6b]: the second request comprises information about loading status of a cell controlled by the first eNB.

151. Centonza discloses that the second request comprises information about loading status of a cell controlled by the first eNB (e.g., the Target eNB). It explains that the selective handover may be based upon the load status of the Target eNB.[148] Information about the load status may be reflected in the second request, such as in the “Cause” information element in the Handover Request, the Selective Handover

[148] *See, e.g.*, Ex-1006, 48, 67, 71; Ex-1005, 16:1–8; *see also* Ex-1005, 26:10–17 (“A need for a selective handover procedure may be determined based on the target base station load status. The radio circuitry 410A may be configured to receive, from the target base station 410B, the target base station load status.”); *id.,* 27:28–37 (“According to some of the example embodiments, the selecting 12 further comprises selecting 24 the sub-set of bearers based on any one or more of a threshold, triggering event, a radio signal level, a buffer level of a bearer, and/or a load situation at the source and/or target base station.”).

Indicator in the Path Switch Request, and/or the Admitted/Not Admitted Lists in the Handover Request Acknowledge.[149] Thus, in my opinion, Centonza discloses this claim element.

8) Claim 7

152. Claim 1 of the '883 patent is drafted towards functionality from the perspective of the first eNB (*e.g.*, the Target eNB). Claim 7 is drafted towards that same functionality from the perspective of the second eNB (*e.g.*, the Source eNB). As I describe below, I incorporate my analysis from claim 1 into this section given the parallel nature of the claims. In my opinion, Centonza anticipates claim 7.

a) [Preamble]: A method for handling inter-node connectivity in a wireless communication system, comprising:

153. This claim element is the same as the preamble of claim 1, which also recites "[a] method for handling inter-node connectivity in a wireless communication system." For the same reasons as my analysis for the preamble element of claim 1, Centonza, including as described in the Centonza Provisional, teaches this claim element.[150]

[149] *See, e.g.*, Ex-1005, 17:5–35, 19:1–25, 22: 1–17; Ex-1006, 50, 52, 55.

[150] *See, e.g.*, Section VIII(A)(2)(a).

b) [7b]: transmitting a first request from a second evolved Node B (eNB) to a first evolved Node B (eNB) for aggregating a Secondary Cell (SCell) for a User Equipment (UE);

154. This claim element is the mirror image of claim 1, which recites "receiving, by a first evolved node B (eNB), a first request from a second eNB for aggregating a Secondary Cell (SCell) for a User Equipment (UE)." This claim element recites "transmitting" that same request from "a second evolved Node B (eNB)." In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of [1b] above, which I incorporate by reference here.[151]

155. As I describe above, Centonza teaches, in connection with the partial handover technology detailed in the reference, that the Source eNB (which is the second eNB of the '883 patent claims) sends a Handover Request to the Target eNB. The Handover Request, as explained above, contains a request for aggregating a Secondary Cell (SCell), such as a small cell or pico cell, for a User Equipment (UE), such as a mobile device.[152] Thus, for the same reasons as my analysis for the 1[b],

[151] *See, e.g.*, Section VIII(A)(2)(b).

[152] *See, e.g.*, Section VIII(A)(2)(b).

Centonza, including as described in the Centonza Provisional, teaches this claim element.

c) [7c]: receiving, by the second eNB, an accept message from the first eNB in response to the first request;

156. This claim element is the mirror image of claim 1, which recites "transmitting an accept message from the first eNB to the second eNB in response to the first request." This claim element recites "receiving" that accept message from "a first eNB." In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of [1c] above, which I incorporate by reference here.[153]

157. As I describe above, Centonza teaches, in connection with the partial handover technology detailed in the reference, that the Target eNB (which is the first eNB of the '883 patent claims) sends a Handover Acknowledgement to the Source eNB (which is the second eNB of the '883 patent claims).[154] That message is accept message, as I detail above.[155] Thus, for the same reasons as my analysis for the 1[c],

[153] *See, e.g.*, Section VIII(A)(2)(c).

[154] *See, e.g.*, Section VIII(A)(2)(c).

[155] *See, e.g.*, Section VIII(A)(2)(c).

Centonza, including as described in the Centonza Provisional, teaches this claim element.[156]

> *d) [7d]: receiving, by the second eNB which controls a Primary Cell (PCell) of the UE, a second request from the first eNB which controls the SCell of the UE; and changing a data path for a first radio bearer of the UE and not changing a data path for a third radio bearer of the UE based on the second request;*

158. This claim element is the mirror image of claim 1, which recites "transmitting a second request from the first eNB, which controls the SCell of the UE, to the second eNB, which controls a Primary Cell (PCell) of the UE, to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE." This limitation recites "receiving" the second request by a second eNB and "changing a data path for a first radio bearer of the UE and not changing a data path for a third radio bearer of the UE based on the second request." In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation or, at a minimum,

[156] *See, e.g.*, Section VIII(A)(2)(c).

renders obvious this claim for the same reasons in my analysis of [1d] above, which I incorporate by reference here, and describe in more detail below.[157]

159. As I explain in [1d], there are multiple messages that meet the "second request" of the '883 patent claims, including the Handover Request, Handover Request Acknowledge, and the Path Switch Request through UE Context Release message that propagates through the core network.[158] These messages meet the "second request" of claim 1 (which is "to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE") as well as this claim ("changing a data path for a first radio bearer of the UE and not changing a data path for a third radio bearer of the UE based on the second request").[159]

160. As I detail above, Centonza teaches that these identified "second requests" are to change a data path and the data path for a first radio bearer (*e.g.*, a bearer contained in the E-RAB elements described above for bearers that are handed

[157] *See, e.g.*, Section VIII(A)(2)(d).

[158] *See, e.g.*, Section VIII(A)(2)(d).

[159] *See, e.g.*, Section VIII(A)(2)(d).

over) and not change the data path for a third radio bearer (*e.g.*, a bearer not contained in the in the E-RAB elements described above for bearers that are handed over or a bearer in the E-RABs Not Admitted List).[160]

161. In addition, as I detail above, the data path for a first radio bearer (*e.g.*, a bearer that is handed over) is changed based on each of the "second request" messages I identify above; likewise, the data path for a third radio bearer (*e.g.*, a bearer that is not handed over) is not changed based on each of the "second request" messages I identify above.[161] The Target eNB also controls an SCell, and the Sourced eNB controls a PCell, as I describe above.[162]

162. In my opinion, each of the "second request" messages I identify in connection with 1[d] are received by the second eNB (the Source eNB). The Handover Request, Handover Acknowledge, and Path Switch Request through UE

[160] *See, e.g.*, Section VIII(A)(2)(d).

[161] *See, e.g.*, Section VIII(A)(2)(d).

[162] *See, e.g.*, Section VIII(A)(2)(d).

Context Release messages are all received by the Source eNB from the Target eNB, as I detail above.[163] Thus, in my opinion, Centonza discloses this claim element.

e) [7e]: wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.

163. This claim element recites the same claim language as 1[e] above: "wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer." In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of [1e] above, which I incorporate by reference here.[164] Thus, in my opinion, Centonza discloses this claim element.

9) Claim 8

a) [Preamble]: The method of claim 7, wherein

164. In my opinion, for the reasons above, Centonza anticipates claim 7 of the '883 patent.

[163] *See, e.g.*, Section VIII(A)(2)(d).

[164] *See, e.g.*, Section VIII(A)(2)(e).

b) [8b]: the data path for the first radio bearer is changed to a second path, wherein the second path is via the second eNB and used as a data path for a second radio bearer of the UE.

165. This claim element is the same as Element [2b]: "the data path for the first radio bearer is changed to a second path, wherein the second path is via the second eNB and used as a data path for a second radio bearer of the UE." In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of [2b] above, which I incorporate by reference here.[165]

10) Claim 9

a) [Preamble]: The method of claim 7, further comprising:

166. In my opinion, for the reasons above, Centonza anticipates or renders obvious claim 7 of the '883 patent.

b) [9b]: transmitting a confirmation message from the second eNB to the first eNB for changing the data path for the first radio bearer.

167. This claim element is the same as [5b] but recites "transmitting a confirmation message" instead of "receiving a confirmation message": "receiving, by the first eNB, a confirmation message from the second eNB for changing the data path for the first radio bearer."

[165] *See, e.g.*, Section VIII(A)(3).

168. In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of Element [5b] above, which I incorporate by reference here.[166] As I describe above, the Target eNB receives a confirmation message from the Source eNB for changing the data path of the first radio bearer (the Handover Confirm message).[167] The Source eNB (the second eNB of the '883 patent claims) transmits that message to the Target eNB (the first eNB of the '883 patent claims), as I describe above.[168]

11) Claim 10

a) [Preamble]: The method of claim 7, wherein

169. In my opinion, for the reasons above, Centonza anticipates claim 7 of the '883 patent.

b) Element [10b]: the UE has multiple paths via different eNBs after the data path for the first radio bearer change.

170. This claim element is the same as [4b]: "wherein the UE has multiple paths via different eNBs after the data path for the first radio bearer change." In my

[166] *See, e.g.*, Section VIII(A)(6).

[167] *See, e.g.*, Section VIII(A)(6).

[168] *See, e.g.*, Section VIII(A)(6).

opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of [4b] above, which I incorporate by reference here.[169]

12) Claim 11

a) [Preamble]: The method of claim 7, wherein

171. In my opinion, for the reasons above, Centonza anticipates claim 7 of the '883 patent.

b) [11b]: the second request comprises information about loading status of a cell controlled by the first eNB.

172. This claim element is the same as Element [6b]: "wherein the second request comprises information about loading status of a cell controlled by the first eNB." In my opinion, Centonza, including as detailed in the Centonza Provisional, teaches this limitation for the same reasons in my analysis of Element [6b] above, which I incorporate by reference here.[170]

[169] *See, e.g.*, Section VIII(A)(5).

[170] *See, e.g.*, Section VIII(A)(7).

B. Ground 2: Centonza Renders Obvious Each of the Challenged Claims

1) Motivation to Modify Centonza

a) Path Switch Request to UE Context Release

173. To the extent the Path Switch Request to UE Context Release the Target eNB provided initially over the S1 interface (through the core network) is not considered "from the first eNB ... to the second eNB" ([1e] and [7e] (similar)), a POSITA would have been motivated to exclusively use X2 for this message.

174. Before the '883 patent, it was known to exchange requests over X2 (including in Centonza).[171] Exclusively using X2 would reduce the network components needed to forward messages to an eNB. This would reduce the network's processing load and the potential for error. Using X2 would also speed up the network, *e.g.*, the message would not need to pass through the core network. And it would allow the network to scale without potentially overloading the core network or expanding the amount of core network components.

175. A POSITA would have further found that using X2 instead of S1 would have a reasonable expectation of success. Centonza and the '883 patent describe the

[171] *See, e.g.*, Ex-1005, Fig. 15; Ex-1006, 46 (Fig. 14).

two options as interchangeable.[172] Indeed, the '883 patent discloses both sending the path switch request directly to the eNB or through the core network, which indicates to a POSITA that the '883 patent claims cover both scenarios. There is also nothing in the '883 patent that indicates that sending the message directly to the eNB or through the core network was inventive or novel, which is consistent with my opinion that, at a minimum, sending the Path Switch Request message directly to the eNB over X2 would have been obvious to a POSITA.

176. Centonza also teaches that, when a bearer is handed over, the eNBs and UE handle the detaching from the old cell, synchronizing to the new cell, forwarding data, and releasing resources without the core network's involvement.[173] A POSITA

[172] *See, e.g.*, Ex-1005, 13:24–26 ("Handover is performed via the X2 connection, whenever available, and if not, using S1 (i.e., involving the Core Network (CN)).");
Ex-1006, 208; Ex-1001 at 7:18–25 ("[T]he second eNB could send a request to the first eNB or a core network node (such as a MME (Mobility Management Entity) or a S-GW (Serving Gateway)), to switch a data path ….”); *id.*, 7:47–51 ("…eNB1 could send a Data Path Switch Request either to eNB2 or to a MWE or a S-GW to change the first data path ....”).

[173] *See, e.g.*, Ex-1005, Fig. 15 (steps 6–11); Ex-1006, Fig. 14 (same).

would thus expect communicating exclusively through X2 would work. And none of the references, or the ’883 patent, express difficultly that would result from exclusively using X2. I am also not aware of any difficulty having the Path Switch Request through UE be transmitted over X2 instead of S1 in light of the disclosure in Centonza.

b) Handover Request Acknowledge and Handover Requests

177. To the extent the Handover Request Acknowledge and Handover Request are not “request[s] . . . to change a data path” ([1d], [7e] (similar)), a POSITA would have been motivated to modify these messages to request to change the data path (and then change the data path based on these messages). The two messages already include a list of E-RABs to handover, like the Path Switch Request. In that scenario, the Source eNB, in addition to changing the DL allocation at the UE and forwarding packets to the Target eNB, could also release its resources for those E-RABs (rather than wait for the UE Context Release or the end marker from the core network). A POSITA would be motivated to make this change to simplify the system and reduce the number of messages exchanged between the eNBs and the core network for the same reasons as above. A POSITA would also have recognized that this change would not have impacted the selective handover system because cells and downlink data path would have already changed at the UE.

A POSITA would thus have a reasonable expectation of success for the same reasons as above.

c) Cause For Data Path Changing and Loading Status

178. To the extent the "second requests" above ([1d] and [7d]) do not include "a cause for data path changing" ([3b]) or "information about loading status of a cell controlled by the first eNB" ([6b] and [11b]), a POSITA would have been motivated to modify Centonza to include that information. Centonza discloses that the eNBs track both sets of data.[174] Including that data in the second request would make the system more efficient by informing the Source eNB (and the core network) of the network conditions in connection with the data-path change. This would assist the system with subsequent handovers based on network conditions. In addition, this approach would reduce the number of messages transmitted through the network, which increases speed and reduces the potential for error.

179. A POSITA would have had a reasonable expectation of success. The "second requests" already include the information elements to carry this data (*e.g.*, Cause, the Selective Handover Indicator, the Admitted/Not Admitted Lists, and

[174] *See, e.g.*, Ex-1006, 48; Ex-1005, 15:42–55, 16:1–8.

Criticality Diagnostics. [175] A POSITA would thus have understood that the modification would simply require taking data Centonza already tracks and including it in an existing message field. This is a small, trivial change, if any, to the existing message structure and processing system in Centonza.

2) Independent Claims

180. Centonza renders obvious claims 1 and 7. Centonza discloses each element of these claims. To the extent Centonza does not disclose [1d] and [7d], it would have been obvious to modify the system for the reasons above to meet those limitations. First, it would have been obvious to have the Target eNB send the Path Switch Request to UE Context Release message to the Source eNB exclusively over X2 and not over S1. Second, it would have been obvious to modify the Handover Request Acknowledge and subsequent Handover Requests to include the same elements as the Path Switch Request. Any of these modifications would have met [1d] and [7d]. The Path Switch Request to UE Context Release would undisputedly be from the Source eNB to the Target eNB without any intervening components as a conduit. The Handover Request Acknowledge and subsequent Handover Requests would also undisputedly contain requests to change the data path.

[175] *See, e.g.*, Ex-1005, 17:5–35, 19:1–25, 22: 1–17; Ex-1006, 50, 52, 55.

3) Dependent Claims

181. Centonza also renders obvious claims 2–6 and 8–11. Centonza discloses each element of these claims. To the extent Centonza does not disclose [3b], it would have been obvious to a POSITA to modify Centonza to meet that element (*e.g.*, include the handover cause in a "second request") based on the motivations I provide above. To the extent Centonza does not disclose [6b] and [11b], it would have been obvious to a POSITA to modify the system to meet that element (*e.g.*, include loading status information in a "second request" based on the motivations I provide above.

C. Ground 3: Han Anticipates Each of the Challenged Claims

1) Han is Prior Art

182. Han ("WO 2014/056130 A1") states that it was filed on October 8, 2012, which predates the earliest priority date listed on the '883 patent (January 30, 2013). I understand that the reference is prior art under Sections 102 and 103.

2) Claim 1

183. Han, in my opinion, anticipates the Challenged Claims of the '883 patent for the following reasons.

a) [Preamble]: A method for handling inter-node connectivity in a wireless communication system, comprising:

184. I have not been asked to assess whether the preamble is a claim limitation. However, to the extent that the preamble is limiting, Han discloses the preamble.

185. As I discuss above, the '883 patent teaches dual connectivity utilizing a macro cell and a small cell. Han discloses the same type of technique to handle inter-node connectivity in a wireless communication system. For example, Han explains that "the concept of 'dual connection' has recently emerged as a way to incorporate LAs [local areas] into cellular networks."[176] The Reference explains that "[t]he basic idea is to let a user equipment (UE) connect to both a macro access point and a LA access point simultaneously, with the macro access point controlling some connection and signaling aspects, such as mobility functions, while offloading most data transmission to the LA access point."[177] This approach, according to Han, "allows the UE to benefit from the high data rate and low required transmission

[176] *See, e.g.*, Ex-1007, [0003].

[177] *See, e.g.*, Ex-1007, [0003].

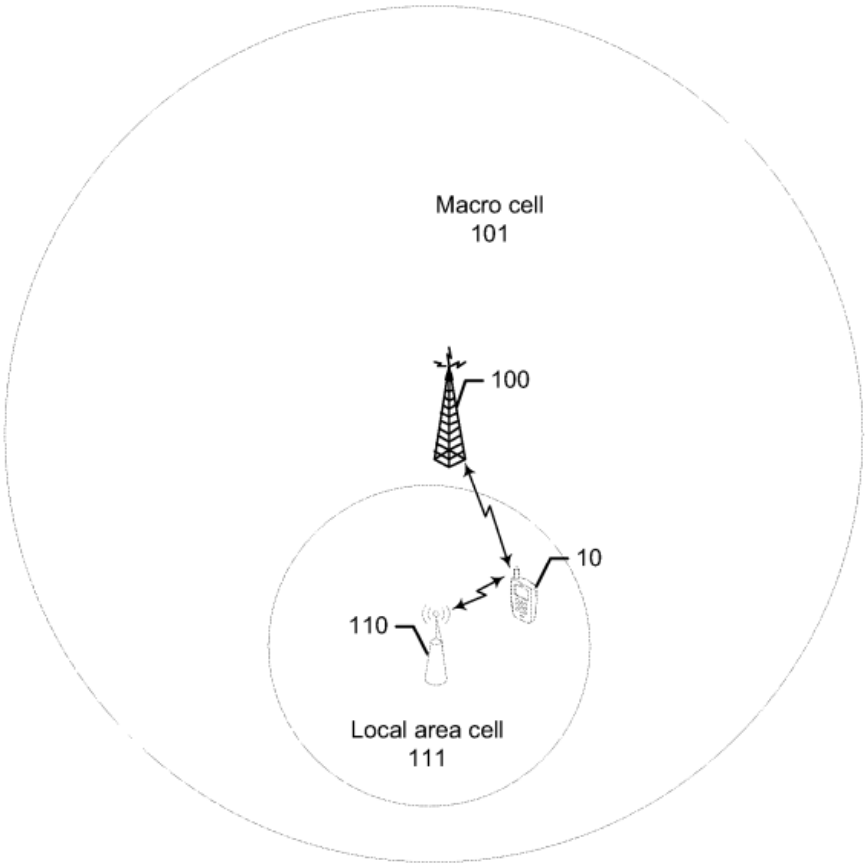
power provided by the LA cell due to its small distance."[178] Han explains that the concept of dual connectivity is "also referred to as inter-eNB CA (inter-enhanced Node B Carrier Aggregation), User/Control (U/C) plane split, multi-stream, etc,"[179] which is similar to how the '883 patent describes the concept (as explained above).

186. Han depicts the macro cell (associated with a macro access point) and a local area cell (associated with a local access point) that provide dual connectivity to a user equipment, such as a mobile device.[180]

[178] *See, e.g.*, Ex-1007, [0003].

[179] *See, e.g.*, Ex-1007, [0003].

[180] *See, e.g.*, Ex-1007, Fig. 1.



187. This depicts a wireless communication system, reflected in the diagram (showing radio towers and a cell phone).

188. Han explains that, as shown in Figure 1, "during dual connection a user equipment (UE), such as UE 10, may be in communication with, e.g., connected to, both a macro access point (MAP) 100, which serves a macro cell 101, and a local access point (LAAP) 110, which supports a local area cell 111."[181] Han explains

[181] *See, e.g.*, Ex-1007, [0017].

that "a macro cell may cover a larger area than local cells, and may even overlap with or encompass one or more local cells." [182]

189. Han explains that the access points disclosed in the Reference "refers to any communication device which provides connectivity to a network, such as a base station, an access node, or any equivalent, such as a Node B, an evolved Node B (eNB), a relay node, or other type of access point."[183] Thus, the Local Area Access Point (or "LAAP") and Macro Access Point (or "MAP") described below are eNBs as claimed per Han.[184]

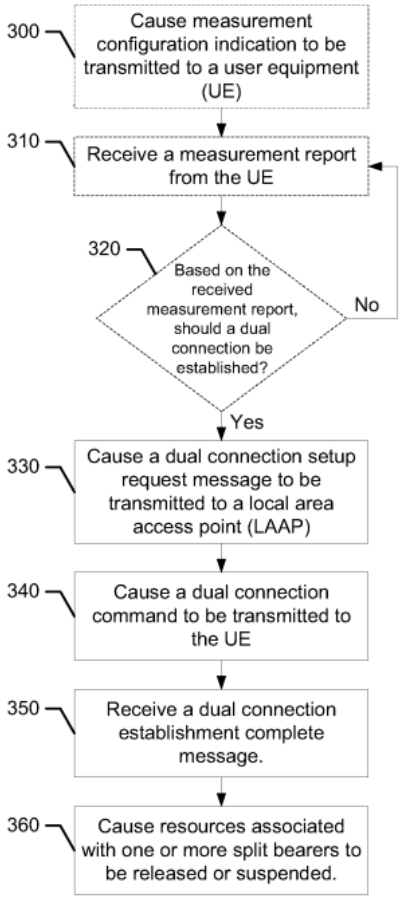
190. Han provides each steps for its technique to handle inter-node connectivity, particularly dual connectivity between nodes.[185]

[182] *See, e.g.*, Ex-1007, [0017].

[183] *See, e.g.*, Ex-1007, [0018].

[184] *See, e.g.*, Ex-1007, [0018].

[185] *See, e.g.*, Ex-1007, Fig. 3; *see also id.* at [0029] ("The most similar scenario to dual connection may be carrier aggregation (CA). With CA, if an access point serving a primary cell needs to enhance the data rate for a given UE, it may configure



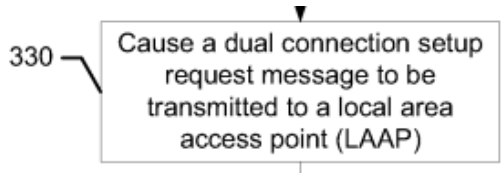
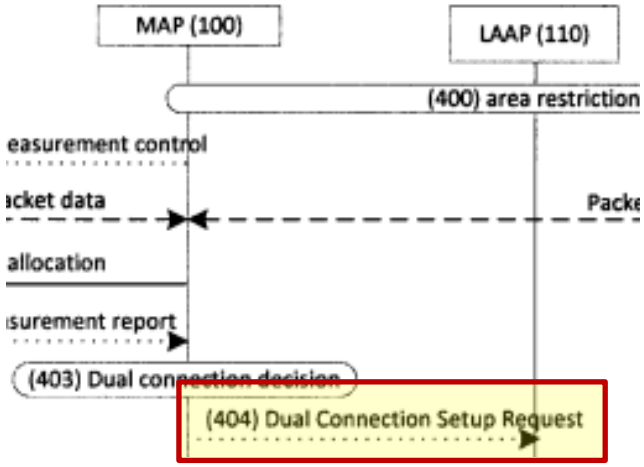
191. Thus, to the extent the preamble is a limitation, in my opinion, Han discloses this limitation for the reasons above.

a secondary cell so that the UE can connect to both the primary cell and secondary cell simultaneously.")

b) [1b]: receiving, by a first evolved node B (eNB), a first request from a second eNB for aggregating a Secondary Cell (SCell) for a User Equipment (UE);

192. Han discloses receiving, by a first evolved node B (eNB) (*e.g.*, the Local Area Access Point or "LAAP"), a first request from a second eNB (*e.g.*, the Macro Access Point or "MAP") for aggregating a Secondary Cell (SCell) for a User Equipment (UE) (*e.g.*, the local cell).

193. Han teaches that the MAP transmits a "dual connection setup" message to the LAAP, which, in turn, receives that message, as depicted below in Figures 3 and 4 from Han (cropped).[186]

Figure 3	**Figure 4**
	

[186] *See, e.g.*, Ex-1007, Figs. 3 and 4.

194. As Han describes, Figure 3 shows that the dual connection setup request "may be transmitted to the LAAP 110."[187] Similarly, Han explains that the MAP transmits a Dual Connection Setup Request to the LAAP, which receives the message.[188] The message may contain information needed to prepare the LAAP for a dual connection, such as "dual connection setup message may include bearer split information. The bearer split information may, for example, indicate which bearer(s) are to be moved and/or created by the LAAP 110 and may also or alternatively include information such as one or more Evolved Packet System (EPS) bearer ids, one or more radio bearer ids, etc. By providing this bearer split information to the LAAP, the LAAP may setup appropriate data bearers for the UE so that, for example, data transmission may be offloaded from the MAP to the LAP."[189] The LAAP and MAP can be eNBs and thus meet the "first eNB" and "second eNB" elements.[190]

[187] *See, e.g.*, Ex-1007, [0034].

[188] *See, e.g.*, Ex-1007, [0040].

[189] *See, e.g.*, Ex-1007, [0040].

[190] *See, e.g.*, Ex-1007, [0018].

195. The Dual Connection Setup Request is a request for aggregating a Secondary Cell (SCell) for a User Equipment (UE), specifically aggregating bearers at the local cell at the LAAP for the UE. Han explains that Dual Connection Request message can include the destination cell ID[191] and that, through the dual connectivity process, the UE has successfully accessed the LA cell.[192] This disclosure reflects that the Dual Connection Setup Request is to aggregate a SCell (*e.g.*, the LA cell) for the UE. Thus, in my opinion, Han discloses this claim element.

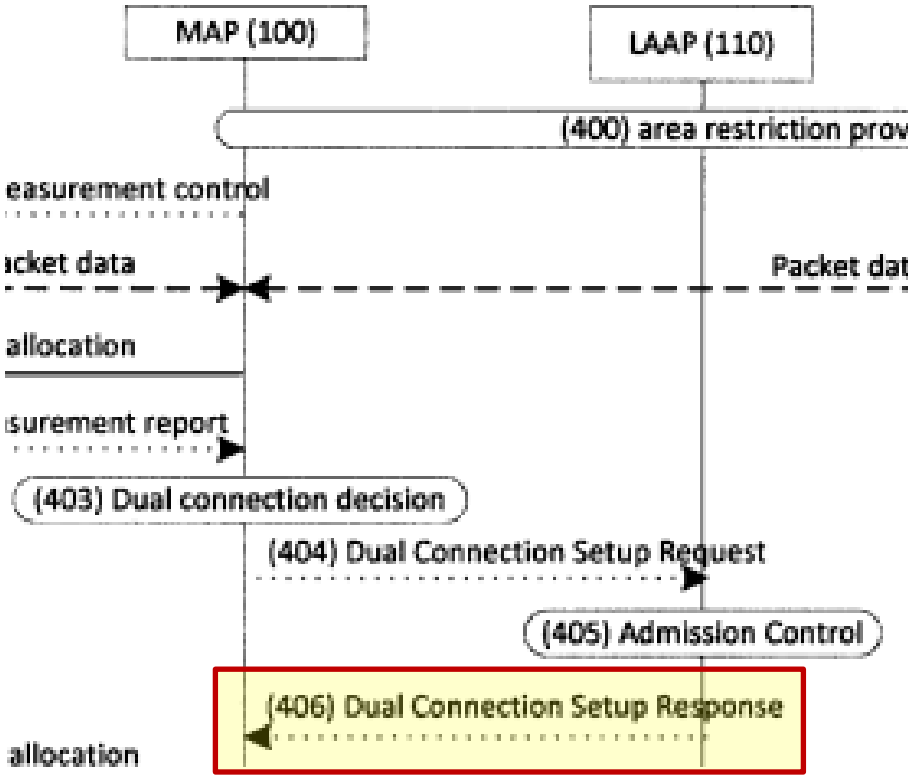
c) [1c]: transmitting an accept message from the first eNB to the second eNB in response to the first request; and

196. Han discloses transmitting an accept message (*e.g.*, the Dual Connection Setup Response message) from the first eNB (*e.g.*, the LAAP) to the second eNB (*e.g.*, the MAP) in response to the first request (*e.g.*, the Dual Connection Setup Request).

[191] *See, e.g.*, Ex-1007, [0040] ("The dual connection setup request message may also include one or more of: a UE X2 signaling context reference at the MAP 100; a UE S 1 Evolved Packet Core (EPC) signaling context reference; a destination cell ID; . . . .").

[192] *See, e.g.*, Ex-1007, [0040], [0044]–[0047].

197. Figure 4 of Han, as depicted below, explains that the LAAP sends the Dual Connection Setup Response to the MAP, which receives the message.[193]



198. Han explains the contents of the Dual Connection Setup Response message:[194]

> At operation 406, the LAAP 110 may prepare the dual connection with Layer- l/Layer-2 (L1/L2) and may transmit a "dual connection setup request acknowledge (ACK)" message to the MAP 100. The dual connection setup request ACK message may include a transparent container to be sent to the UE as an RRC message to

[193] *See, e.g.*, Ex-1007, Fig. 4, [0034].

[194] *See, e.g.*, Ex-1007, Fig. 4, [0042].

> perform the dual connection setup. The container may, for example, include a new C-RNTI, LAAP 110 security algorithm identifiers for the selected security algorithms, a dedicated RACH preamble, and/or other possible parameters, such as access parameters, System Information Blocks (SIBs), etc. The dual connection setup request ACK message may also include RNL/TNL information for the forwarding tunnels, if necessary.

199. Thus, in my opinion, Han discloses this claim element.

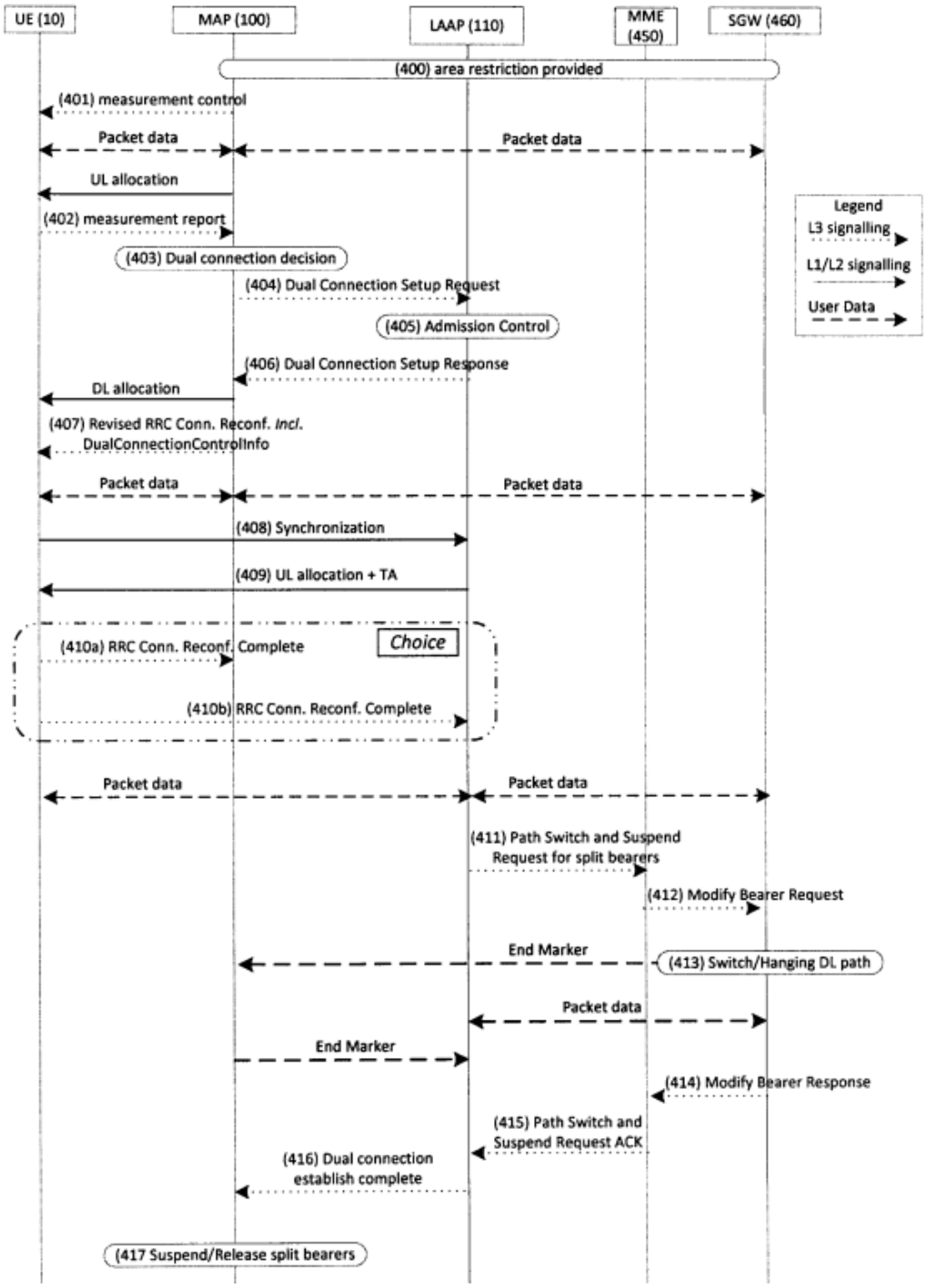
d) [1d]: transmitting a second request from the first eNB, which controls the SCell of the UE, to the second eNB, which controls a Primary Cell (PCell) of the UE, to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE;

200. Han discloses transmitting a second request from the first eNB (*e.g.*, the LAAP), which controls the SCell of the UE, to the second eNB (*e.g.*, the MAP), which controls a Primary Cell (PCell) of the UE, to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE.

201. As detailed above, the LAAP controls a Local Area (or "LA") cell of the UE, which is a SCell of the UE. The MAP controls the macro cell of the UE, which is a PCell of the UE. Han discloses macro cells and LA cells. This is the same disclosure as the '883 Patent, which explains that the "[t]he PCell could be a macro cell, and the SCell could be a small cell." Ex-1001 at 6:66–67.

202. The LAAP transmits (and the MAP receives) a second request to change a radio bearer of the UE which does not indicate a change for a third radio bearer. Han discloses this request in multiple places. I will describe each of these disclosures with reference to Figure 4 from Han, which I have reproduced (in cropped form) below.[195]

[195] *See, e.g.*, Ex-1007, Fig. 4.



203. The first message that meets this limitation is the Dual Connection Setup Response, shown above at operation 406. This message is sent from the LAAP to the MAP, as depicted above. Han explains that this message includes a

request to change a data path for a first radio bearer of the UE. For example, the message may include "a transparent container to be sent to the UE as an RRC [Radio Resources Control] message to perform the dual connection setup."[196] This is shown in the Figure 4 in the "DL allocation" message from the MAP to the UE and the transmissions from the MAP to the UE in step 407 that ultimately reconfigure the UE to successfully access the LA cell and, at step 410b, "confirm the dual connection establishment procedure is completed" for the UE.[197] During this process, the LAAP "may being sending data to the UE 10 for split bearers."[198] The MAP then changes the data path based on this message, as shown in the "DL allocation" message and subsequent transmissions that result in (step 410b) "confirm[ing] the dual connection establishment procedure is completed" an allowing the LAAP to "begin sending data to the UE 10 for split bearers."[199] This disclosures shows that the request was to change the data path for a bearer.

[196] *See, e.g.*, Ex-1007, [0042].

[197] *See, e.g.*, Ex-1007, Fig. 4; *id.*, [0043]–[0047].

[198] *See, e.g.*, Ex-1007, Fig. 4; *id.*, [0046].

[199] *See, e.g.*, Ex-1007, [0042].

204. The second message that meets this limitation is the Path Switch and Suspend Request For Split Bearers through the Dual Connection Establish Complete (shown in Step 411 in Figure 4).

205. The message includes "split bearer information, such as information indicating one or more bearers of the UE 10 that have moved to the LAAP 110." [200] This message propagates through the core network (the MME and SGW), resulting in the Dual Connection Establish Complete (step 416).[201] As part of this process, the SGW "may then switch the DL data path for split bearers to the LA cell 110 side," send an end-marker to the MAAP, and then "release or suspend, e.g., hang, any U-plane/TNL resources of split bearers towards the MAP."[202] The MAP "may … suspend/hang the one or more split bearers upon receiving the end marker from the SGW."[203]

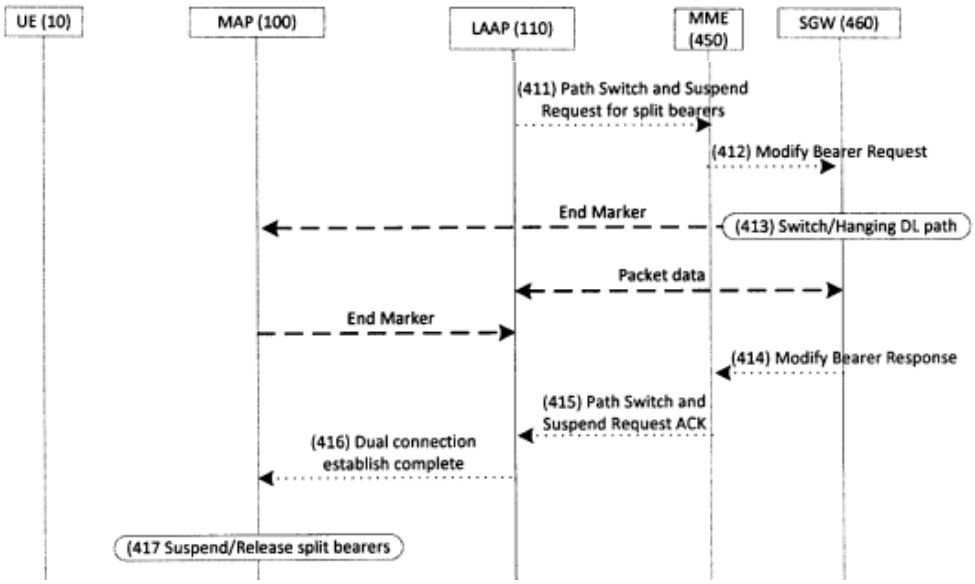
[200] *See, e.g.*, Ex-1007, [0050].

[201] *See, e.g.*, Ex-1007, Fig. 4.

[202] *See, e.g.*, Ex-1007, [0052].

[203] *See, e.g.*, Ex-1007, [0052].

206. This is a request to change the data path that propagates through the core network, as shown below in the cropped image of Figure 4 from Han, ultimately resulting in the Dual Connection Establish Complete message (at step 416).[204] It is a request from the LAAP to the MAP. The core network devices, such as the MME and SGW, act as a conduit for the message.



207. Han explains that this message is a request to change the data path, resulting in (at Step 417) that the MAP "may release or suspend/hang radio and C-

[204] *See, e.g.*, Ex-1007, Fig. 4.

plane [control plane] related resources associated with the one or more split bearers for the UE 10."[205]

208. Han explains, at Step 411, "[t]he path switch/suspend request message may further include split bearer information, such as information indicating one or more bearers of the UE 10 that have moved to the LAAP 110."[206] This message propagates through the core network (the Mobile Mobility Entity, the MME, and the Service Gateway, the SGW), resulting in the Dual Connection Establish Complete (shown at Step 416).[207] As part of this process, the SGW "may then switch the DL data path for split bearers to the LA cell 110 side."[208] The SGW "may then send one or more 'end marker' packets via the old path to the MAP and then can release or suspend, e.g., hang, any U-plane/TNL resources of split bearers towards the MAP.

[205] *See, e.g.*, Ex-1007, [0056].

[206] *See, e.g.*, Ex-1007, [0050].

[207] *See, e.g.*, Ex-1007, Fig. 4.

[208] *See, e.g.*, Ex-1007, [0052].

The MAP 100 may, according to an example embodiment, suspend/hang the one or more split bearers upon receiving the end marker from the SGW."[209]

209. Han explains that Dual Connection Establish Complete, which "informs the MAP 100 of the successful dual connection establishment and triggers the release or suspension/hanging of resources for split bearers by the MAP 100."[210]

> At operation 416, the LAAP 110 may transmit a "dual connection establishment complete" message to the MAP 100, which informs the MAP 100 of the successful dual connection establishment and triggers the release or suspension/hanging of resources for split bearers by the MAP 100. The LAAP 110 may, according to an example embodiment, send this message after receiving a path switch/suspend request message from the MME 450.

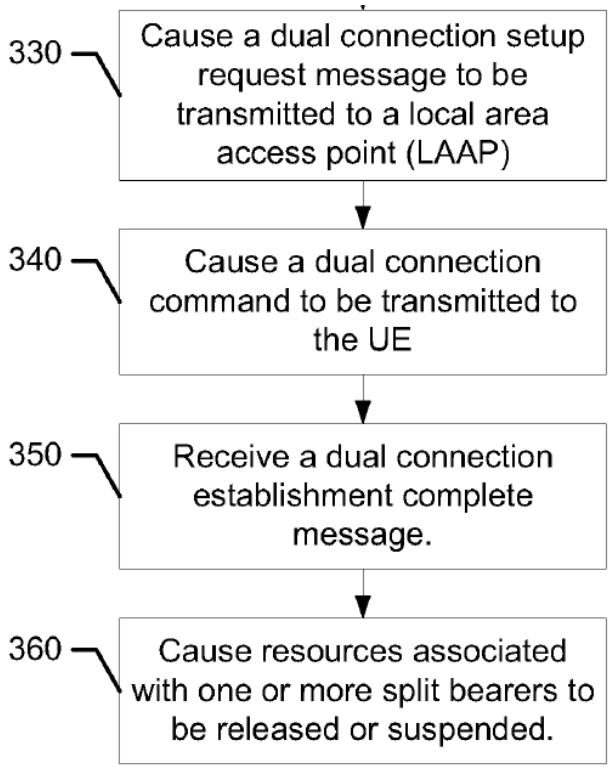
210. Han explains that, "upon reception of the dual connection establishment complete message," the MAP "may release or suspend/hang radio and C-plane related resources associated with the one or more split bearers for the UE 10."[211]

[209] *See, e.g.*, Ex-1007, [0052].

[210] *See, e.g.*, Ex-1007, [0055].

[211] *See, e.g.*, Ex-1007, [0056].

211. Han also depicts these sequence of steps in Figure 3, a cropped version of which is depicted below.[212] It shows that the receipt of the dual connection establishment complete message (step 350) ultimately "[c]ause[s] resources associated with one or more split bearers to be released or suspended."[213]



[212] *See, e.g.*, Ex-1007, Fig. 3.

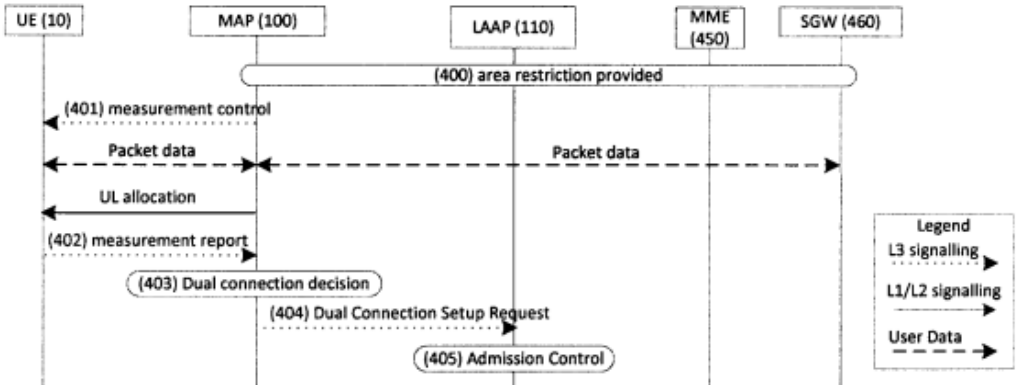
[213] *See, e.g.*, Ex-1007, Fig. 3; *id.* at [0034] ("[T]he apparatus embodied by or otherwise associated with the MAP 100 may cause radio and/or C-plane related resources associated with split bearer(s) for the UE 10 to be released or suspended.").

212. This disclosure explains that the message that propagates through the network that is sent from the LAAP and received by the MAP, starting with the Path Switch and Suspend Request for Split Bearers (at Step 411) through the Dual Connection Establish Complete (Step 416) is a second request from the first eNB (*e.g.*, the LAAP), which controls the SCell of the UE (*e.g.*, the LA cell), to the second eNB (*e.g.*, the MAP), which controls a Primary Cell (PCell) of the UE (*e.g.*, the macro cell), to change a data path for a first radio bearer of the UE (*e.g.*, one of the split bearers listed in the split bearer information moved), wherein the second request does not indicate to change the data path for a third radio bearer of the UE (*e.g.*, one of the bearers that is not moved over).[214]

213. The third message that meets this limitation is the Dual Connection Setup Request (step 404), which Han shows below in Figure 4 (cropped).[215]

[214] *See, e.g.*, Ex-1007, Fig. 4, [0050]–[0056] (describing steps 411 to 417 in Figure 4, resulting in MAP "may release or suspend/hang radio and C-plane related resources associated with the one or more split bearers for the UE 10").

[215] *See, e.g.*, Ex-1007, Fig. 4, [0040] (describing the Dual Connection Setup Request).



214. Han explains that the Dual Connection Setup Request is to change a data path for a first radio bearer of the UE (*e.g.*, one of the split bearers listed in the split bearer information moved), wherein the second request does not indicate to change the data path for a third radio bearer of the UE (*e.g.*, one of the bearers that is not moved over). Han explains that the Dual Connection Setup Request may "include split bearer information," which may "indicate which bearer(s) are to be moved and/or created by the LAAP 110."[216] The Dual Connection Setup Request may also contain "information such as one or more Evolved Packet System (EPS) bearer ids, one or more radio bearer ids, etc."[217] Han explains that, by providing this bearer split information, "the LAAP may setup appropriate data bearers for the UE so that, for example, data transmission may be offloaded from the MAP to the

[216] *See, e.g.*, Ex-1007, [0040].

[217] *See, e.g.*, Ex-1007, [0040].

LAP."[218] This offloading occurs in connection with changing the data path, reflecting that the Dual Connection Setup Request includes a request to change the data path.

215. While Figure 4 shows that the Dual Connection Setup Request sent from the MAP to the LAAP, Han explains that the when the sending apparatus is "embodied by or otherwise associated with a LAAP, the dual connection setup message may be transmitted to the MAP 100."[219] In that instance, the Dual Connection Setup Request is a second request from the first eNB (*e.g.*, the LAAP), which controls the SCell of the UE (*e.g.*, the LA cell), to the second eNB (*e.g.*, the MAP), which controls a Primary Cell (PCell) of the UE (*e.g.*, the macro cell), to change a data path for a first radio bearer of the UE (*e.g.*, one of the split bearers listed in the split bearer information moved), wherein the second request does not indicate to change the data path for a third radio bearer of the UE (*e.g.*, one of the bearers that is not moved over). Han further explains that the LAP and MAP functionality is interchangeable between the devices because each device includes an apparatus "for causing their respective network entities to carry out the operations

[218] *See, e.g.*, Ex-1007, [0040].

[219] *See, e.g.*, Ex-1007, [0034].

depicted in Figure 4," including "for causing their respective associated network entities to transmit and/or receive the depicted signals."[220]

216. Han teaches that its techniques relate to cellular networks, such as LTE networks[221] (which, as I discussed above, the LTE specification available at the time disclosed support for up to 11 and potentially up to 256 radio bearers).

217. None of these messages (the Dual Connection Setup Response, the Dual Connection Setup Request when made from the LAAP, and the message from the Path Switch and Suspend Request for split bearers to the Dual Connection Establish Complete) indicate to change the data path for a third radio bearer of the UE. The messages each contain a list of the bearers to be moved over, such as bearer

[220] *See, e.g.*, Ex-1007, [0031].

[221] *See, e.g.*, Ex-1007, [0003] (explaining that the incorporation of local area networks "into the broader network infrastructure may be the next frontier in the evolution of cellular networks, such as Long Term Evolution (LTE) networks"); *id.*, [0017] (explaining that the system described in the reference may support "a Long Term Evolution (LTE) network" or "an LTE-Advanced (LTE-A) network"); *id.*, [0040] (disclosing that the Dual Connection Setup Request can include an E-RAB context).

identification information and data for a downlink path change. And they are sent from the LAAP to the MAP (either directly, in the case of the Dual Connection Setup Response, the Dual Connection Setup Request, and Dual Connection Establish Complete, or as transmitted from the LAAP, propagated through the cellular network, and received by the MAP in the case of the Path Switch Request to the Dual Connection Establish Complete).

218. All of these messages are requests to change the data path of a radio bearer. The messages each contain a listing of radio bearers for which the LAAP requests a change in the data path, as detailed above. In the case of the Dual Connection Establish Complete, the message causes the MAP to release the resources associated with the subset of bearers moved over. Thus, in my opinion, Han discloses this claim element.

> *e) [1e]: wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.*

219. Han discloses that a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer. It teaches that the first path is via the first eNB (LAAP) and is used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.

220. Han teaches a dual connection between a MAP and a LAAP that allows for splitting bearers between the nodes (both to and from each node).[222] When this occurs, the first and third radio bearer (*e.g.*, two of the 11+ potential bearers) utilize the same first data path prior to the handover of the first radio bearer (*e.g.*, one of the bearers), including bearers at the LAAP. Han discloses that the LAPP can send a Dual Connection Setup Request to the MAP and that the split-bearer functionality is interchangeable between the devices, [223] meaning that the first data path is via the LAAP (first eNB) for a first and third radio bearer (*e.g.*, two bearers). This path exists prior to moving over the first radio bearer.

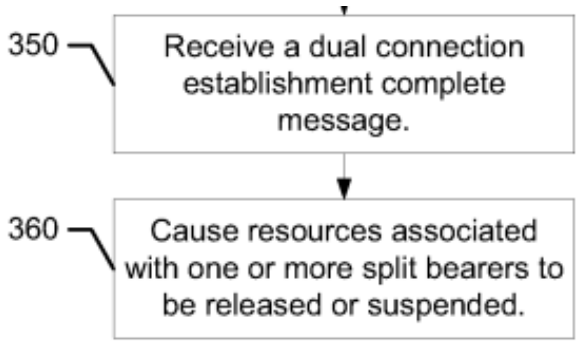
221. Han explains it causes "a dual connection message to be transmitted, causing a dual connection command to be transmitted to a UE, receiving a dual connection establishment complete message, and causing resources associated with one or more split bearers to be released or suspended."[224]

[222] *See, e.g.*, Ex-1007, [0005]–[0008].

[223] *See, e.g.*, Ex-1007, Ex-1007, [0031], [0034].

[224] *See, e.g.*, Ex-1007, [0005]; *id.* at [0006], [0007] (disclosing technique to "cause a dual connection message to be transmitted, cause a dual connection command to be transmitted to a UE, receive a dual connection establishment complete message,

222. Han explains, in connection with Figure 3 (a cropped version of which is below) that, it provides "for causing resources associated with one or more split bearers to be released or suspended, such as in operation 360.[225]



and cause resources associated with one or more split bearers to be released or suspended"); *id.* at [0008] (disclosing "an apparatus is provided that includes means for causing a dual connection message to be transmitted, means for causing a dual connection command to be transmitted to a UE, means for receiving a dual connection establishment complete message, and means for causing resources associated with one or more split bearers to be released or suspended").

[225] *See, e.g.*, Ex-1007, Fig. 3, [0034].

223. Han explains that the techniques it describes "may cause radio and/or C-plane related resources associated with split bearer(s) for the UE 10 to be released or suspended."[226]

224. Han also details that "the dual connection setup message may include bearer split information," including bearer split information that can include information that indicates "which bearer(s) are to be moved and/or created by the LAAP 1 10 and may also or alternatively include information such as one or more Evolved Packet System (EPS) bearer ids, one or more radio bearer ids, etc."[227] Han teaches that "[b]y providing this bearer split information to the LAAP, the LAAP may setup appropriate data bearers for the UE so that, for example, data transmission may be offloaded from the MAP to the LAP."[228] Han teaches show the split bearers are moved over and changing the data path.[229]

> It should be noted that, for downlink (DL) data, the MAP 100 may continue to transmit DL data to the UE 10 for the one or more split bearers until all data for the one or more

[226] *See, e.g.*, Ex-1007, [0034].

[227] *See, e.g.*, Ex-1007, [0040].

[228] *See, e.g.*, Ex-1007, [0040].

[229] *See, e.g.*, Ex-1007, [0048].

> split bearers are correctly transmitted to the UE 10. The MAP may determine whether all of the DL data has been transmitted out, for example, based on a data buffer of the MAP. On the other hand, for UL data, the UE may stop UL data transmissions for the one or more split bearers in the macro cell 101 when the UE 10 receives the RRCConnectionReconfiguration message including the DualConnectionControlInfo IE. The UE 10 may then begin UL data transmissions for the one or more split bearers in the LA cell 111 after the UE receives an UL grant from the LAAP 110. By stopping UL transmissions in this way, the MAP 100 may be ensured to receive a complete Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU) in case the PDCP PDU is being transmitted when the RRCConnectionReconfiguration is received. Thus, no partially received PDCP PDUs may be left in the buffer of the MAP 100 when transmission moves to the LA cell 111. This may prevent the MAP from needing to forward data and/or transfer PDCP status to the LAAP 110.

225. This disclosure teaches a first path via the LAAP (the first eNB of the '883 patent claims) that is used as the data path for the first radio bearer and the third radio bearer (the bearers prior to moving over the bearers between the MAP and the LAAP). After the first radio bearer has been moved and/or created as a result of the setting up the dual connection, the third radio bearer remains on the original data path.

226. In addition, Han discloses that the LAP can send a Dual Connection Setup Request to the MAP.[230] Han further explains that the LAP and MAP

[230] *See, e.g.*, Ex-1007, [0034].

functionality is interchangeable between the devices because each device includes an apparatus "for causing their respective network entities to carry out the operations depicted in Figure 4," including "for causing their respective associated network entities to transmit and/or receive the depicted signals."[231] In that instance, the dual connectivity functionality in Han would also change the data path for a bearer that was via the LAAP to via the MAP. Thus, in my opinion, Han discloses this claim element.

3) Claim 2

a) [Preamble]: The method of claim 1, wherein

227. In my opinion, for the reasons above, Han anticipates claim 1 of the '883 patent.

b) [2b]: the data path for the first radio bearer is changed to a second path, wherein the second path is via the second eNB and used as a data path for a second radio bearer of the UE.

228. Han, in my opinion, discloses this claim element. As detailed above, Han discloses that the data path for the first radio bearer (*e.g.*, the data path for a bearer at the LAAP) is changed to a second path via the second eNB (*e.g.*, the data path for a bearer at the MAP after the selective handover) and is used a data path for

[231] *See, e.g.*, Ex-1007, [0031].

a second radio bearer of the UE (*e.g.*, a bearer at the MAP prior to the handover that remains at the MAP). I also incorporate my analysis and citations to Han from [1e] above.

229. Han discloses that the data path for the first radio bearer (*e.g.*, the data path for a bearer at the LAAP) is changed to a second path via the second eNB (*e.g.*, the data path for a bearer at the MAP after splitting the bearers) and is used a data path for a second radio bearer of the UE (*e.g.*, a bearer at the MAP prior to the offloading that remains at the MAP).[232] Han provides for dual connectivity that offloads or moves a subset of bearers, which changes the data path for the bearers selectively moved over (*e.g.*, in split bearer information) but does not change the data path for the bearers that are not moved over.[233]

230. As I discuss in the section above, Han provides for dual connectivity that offloads or moves a subset of bearers, which changes the data path for the bearers selectively moved over (*e.g.*, in split bearer information) but does not change

[232] *See, e.g.*, Ex-1007, Fig. 3, Fig. 4, [0005]–[0008], [0033], [0034], [0038]. [0040], [0048].

[233] *See, e.g.*, Ex-1007, Fig. 3, Fig. 4, [0005]–[0008], [0033], [0034], [0038]. [0040], [0048].

the data path for the bearers that are not moved over. These disclosures, in my opinion, teach that, when the data path of one radio bearer is changed from on access point to another (such as from the LAAP to the MAP) and the data path for another radio bearer remains unchanged (*e.g.*, a bearer that is not moved over), that the offloaded bearer and the unchanged bearer use the same data path after the dual connectivity set up (*e.g.*, both use the data path via the MAP), including as discussed above.[234]

231. Han explains the changing of the data paths (in the downlink and uplink direction) as follows.[235]

> It should be noted that, for downlink (DL) data, the MAP 100 may continue to transmit DL data to the UE 10 for the one or more split bearers until all data for the one or more split bearers are correctly transmitted to the UE 10. The MAP may determine whether all of the DL data has been transmitted out, for example, based on a data buffer of the MAP. On the other hand, for UL data, the UE may stop UL data transmissions for the one or more split bearers in the macro cell 101 when the UE 10 receives the RRCConnectionReconfiguration message including the DualConnectionControlInfo IE. The UE 10 may then begin UL data transmissions for the one or more split bearers in the LA cell 111 after the UE receives an UL

[234] *See, e.g.*, Ex-1007, Fig. 3, Fig. 4, [0005]–[0008], [0033], [0034], [0038], [0040], [0048].

[235] *See, e.g.*, Ex-1007, [0048].

> grant from the LAAP 110. By stopping UL transmissions in this way, the MAP 100 may be ensured to receive a complete Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU) in case the PDCP PDU is being transmitted when the RRCConnectionReconfiguration is received. Thus, no partially received PDCP PDUs may be left in the buffer of the MAP 100 when transmission moves to the LA cell 111. This may prevent the MAP from needing to forward data and/or transfer PDCP status to the LAAP 110.

232. This disclosure, consistent with the remainder of Han, shows the changing of the data path for a radio bearer from a first path to a second path. It shows there is a second bearer on that second path already (*e.g.*, a bearer on the second path that is not moved over). Thus, in my opinion, Han discloses this claim element.

4) Claim 3

a) [Preamble]: The method of claim 1, wherein

233. In my opinion, for the reasons above, Han anticipates claim 1 of the ’883 patent.

b) [3b]: the second request includes a cause for data path changing.

234. In my opinion, Han explains that the second request may include a cause for data path changing (*e.g.*, measurement configuration, report information, traffic types, and results and determining whether a dual connection should be

established).[236] Han explains that the messages received by the access points "receive one or more further measurement reports and similarly determine, based on those measurement reports, whether a dual connection should then be established."[237]

> In an instance in which it is determined that a dual connection should not be established, the apparatus may, for example, receive one or more further measurement reports and similarly determine, based on those measurement reports, whether a dual connection should then be established. Conversely, the apparatus may proceed with the operations described below in an instance in which it is determined that a dual connection should be established, so as to cause a dual connection involving the determined LAAP to be established.

235. Han thus teaches that the access points may receive, including as part of the second request, a cause for the data path change. Thus, in my opinion, Han discloses this claim element.

5) Dependent Claim 4

a) [Preamble]: The method of claim 1, wherein

236. In my opinion, for the reasons above, Han anticipates claim 1 of the '883 patent.

[236] *See, e.g.*, Ex-1007, [0032], [0033]

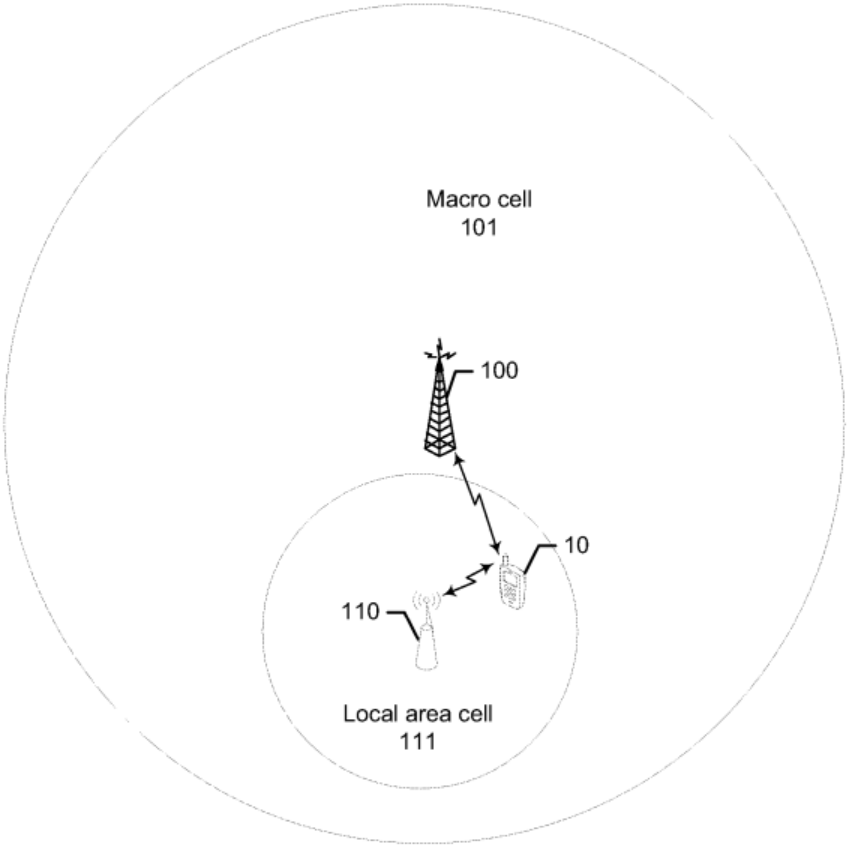
[237] *See, e.g.*, Ex-1007, [0033]; *id.*, [0040] (disclosing Quality of Service profiles).

b) [4b]: the UE has multiple paths via different eNBs after the data path for the first radio bearer change.

237. In my opinion, Han discloses that the User Equipment (UE) has multiple paths via different eNBs (the MAP and LAAP) after the data path for the first radio bearer change.

238. The Reference, as detailed above, discloses that after the moving of a bearer from one access point to another as part of dual connectivity, that the UE has multiple data paths via different eNBs, such as the data path via the MAP and the LAAP.[238]

[238] *See, e.g.*, Ex-1007, Fig. 1.



239. Han explains that, dual connectivity, as the Reference teaches, "let[s] a user equipment (UE) connect to both a macro access point and a LA access point simultaneously, with the macro access point controlling some connection and signaling aspects, such as mobility functions, while offloading most data transmission to the LA access point."[239] "The concept of dual connection is also referred to as inter-eNB CA (inter-enhanced Node B Carrier Aggregation)," among

[239] *See, e.g.*, Ex-1007, [0003].

others,[240] which is the type of technique that the ’883 patent discloses and claims. Han thus discloses that, after the dual connectivity setup has completed (and the path for a first radio bearer has changed), the UE has multiple paths via different eNBs (paths via the MAP and paths via the LAAP).[241]

240. Thus, in my opinion, Han discloses this claim element.

6) Dependent Claim 5

a) [Preamble]: The method of claim 1, further comprising:

241. In my opinion, for the reasons above, Han anticipates claim 1 of the ’883 patent.

[240] *See, e.g.*, Ex-1007, [0003].

[241] *See, e.g.*, Ex-1007, Fig. 1, Fig. 3, [0003], [0017] (“As depicted, during dual connection a user equipment (UE), such as UE 10, may be in communication with, e.g., connected to, both a macro access point (MAP) 100, which serves a macro cell 101, and a local access point (LAAP) 110, which supports a local area cell 111.”); *id.*, [0029] (“The most similar scenario to dual connection may be carrier aggregation (CA). With CA, if an access point serving a primary cell needs to enhance the data rate for a given UE, it may configure a secondary cell so that the UE can connect to both the primary cell and secondary cell simultaneously.”)

b) [5b]: receiving, by the first eNB, a confirmation message from the second eNB for changing the data path for the first radio bearer.

242. In my opinion, for the reasons above, Han anticipates claim 1 of the '883 patent.

243. In my opinion, Han discloses receiving, by the first eNB (*e.g.*, the LAAP), a confirmation message from the second eNB (*e.g.*, the MAP) for changing the data path for the first radio bearer. Han discloses that the MAP receives an "end-marker" message and then "can release or suspend, e.g., hang, any U-plane/TNL resources of split bearers towards the MAP."[242] "The MAP 100 may further send the end marker to the LAAP 110."[243] This message is a confirmation message for changing the data path for the first radio bearer (*e.g.*, confirming that the bearer has been successfully moved over).

244. Han also that the LAAP could send a Dual Connection Setup Request.[244] In that instance, the Dual Connection Establish Complete (another form

[242] *See, e.g.*, Ex-1007, [0052].

[243] *See, e.g.*, Ex-1007, [0052].

[244] *See, e.g.*, Ex-1007, [0034].

of the claimed confirmation message) would be sent from the MAP to the LAAP based on Han flow in Figure 4.[245] The Dual Connection Establishment Complete message informs the receiving device "of the successful dual connection establishment."[246]

245. Han further explains that the LAP and MAP functionality is interchangeable between the devices because each device includes an apparatus "for causing their respective network entities to carry out the operations depicted in Figure 4," including "for causing their respective associated network entities to transmit and/or receive the depicted signals."[247] In that instance, the dual connectivity functionality in Han would provide the Dual Connection Establishment Complete message from the MAP to the LAAP. Thus, in my opinion, Han discloses this claim element.

[245] *See, e.g.*, Ex-1007, Fig. 4, [0006], [0007], [0008].

[246] *See, e.g.*, Ex-1007, [0055].

[247] *See, e.g.*, Ex-1007, [0031].

7) Claim 6

a) [Preamble]: The method of claim 1, wherein

246. In my opinion, for the reasons above, Han anticipates claim 1 of the ’883 patent.

b) [6b]: the second request comprises information about loading status of a cell controlled by the first eNB.

247. Han discloses that the second request comprises information about loading status of a call controlled by the first eNB (e.g., the LAAP).

248. As I discuss in the section above, Han provides for dual connectivity that offloads or moves a subset of bearers, which changes the data path for the bearers selectively moved over (*e.g.*, in split bearer information) but does not change the data path for the bearers that are not moved over. These disclosures, in my opinion, teach that, when the data path of one radio bearer is changed from on access point to another (such as from the LAAP to the MAP) and the data path for another radio bearer remains unchanged (*e.g.*, a bearer that is not moved over), that the offloaded bearer and the unchanged bearer use the same data path after the dual

connectivity set up (*e.g.*, both use the data path via the MAP), including as detailed above.[248]

249. Han explains the changing of the data paths (in the downlink and uplink direction) as follows.[249]

> It should be noted that, for downlink (DL) data, the MAP 100 may continue to transmit DL data to the UE 10 for the one or more split bearers until all data for the one or more split bearers are correctly transmitted to the UE 10. The MAP may determine whether all of the DL data has been transmitted out, for example, based on a data buffer of the MAP. On the other hand, for UL data, the UE may stop UL data transmissions for the one or more split bearers in the macro cell 101 when the UE 10 receives the RRCConnectionReconfiguration message including the DualConnectionControlInfo IE. The UE 10 may then begin UL data transmissions for the one or more split bearers in the LA cell 111 after the UE receives an UL grant from the LAAP 110. By stopping UL transmissions in this way, the MAP 100 may be ensured to receive a complete Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU) in case the PDCP PDU is being transmitted when the RRCConnectionReconfiguration is received. Thus, no partially received PDCP PDUs may be left in the buffer of the MAP 100 when transmission moves to the LA cell 111. This may prevent the MAP from needing to forward data and/or transfer PDCP status to the LAAP 110.

[248] *See, e.g.*, Ex-1007, Fig. 3, Fig. 4, [0005]–[0008], [0033], [0034], [0038], [0040], [0048].

[249] *See, e.g.*, Ex-1007, [0048].

250. Han explains that load information may determine if a dual connection should be established: "[o]ther factors which the determination may be based on may include, for example, macro cell load and/or traffic types. In an instance in which it is determined that a dual connection should not be established, the apparatus may, for example, receive one or more further measurement reports and similarly determine, based on those measurement reports, whether a dual connection should then be established."[250] Thus, in my opinion, Han discloses this claim element.

[250] *See, e.g.*, Ex-1007, [0033]. Han also discloses that a message from UE to the LAAP can include a Buffer Status Report, which would reflect the loading status. *Id.* at [0046] ("At operation 410a, according to one example embodiment, once the UE 10 has successfully accessed the LA cell 111, the UE may transmit the RRCConnectionReconfigurationComplete message, e.g., including C-RNTI, to confirm the dual connection establishment, along with an uplink Buffer Status Report, whenever possible, to the LAAP 1 10 to indicate that the dual connection establishment procedure is completed for the UE 10. The LAAP 1 10 may then verify the C-RNTI transmitted in the RRCConnectionReconfigurationComplete message. The LAAP 110 may then begin sending data to the UE 10 for split bearers.").

8) Claim 7

251. Claim 1 of the ’883 patent is drafted towards functionality from the perspective of the first eNB (*e.g.*, the LAAP). Claim 7 is drafted towards that same functionality from the perspective of the second eNB (*e.g.*, the MAP). As I describe below, I incorporate my analysis from claim 1 into this section given the parallel nature of the claims.

> *a) [Preamble]: A method for handling inter-node connectivity in a wireless communication system, comprising:*

252. This claim element is the same as the preamble of claim 1, which also recites “[a] method for handling inter-node connectivity in a wireless communication system.” For the same reasons as my analysis for the preamble element of claim 1, Han.[251]

> *b) [7b]: transmitting a first request from a second evolved Node B (eNB) to a first evolved Node B (eNB) for aggregating a Secondary Cell (SCell) for a User Equipment (UE);*

253. This claim element is the mirror image of claim 1, which recites “receiving, by a first evolved node B (eNB), a first request from a second eNB for aggregating a Secondary Cell (SCell) for a User Equipment (UE).” This claim

[251] *See, e.g.*, Section VIII(C)(2)(a).

element recites "transmitting" that same request from "a second evolved Node B (eNB)." In my opinion, Han teaches this limitation for the same reasons in my analysis of [1b] above, which I incorporate by reference here.[252]

254. As I describe above, Han teaches, in connection with the dual connectivity technology detailed in the reference, that the MAP (which is the second eNB of the '883 patent claims) sends Dual Connection Setup Request to the LAAP. The Dual Connection Setup Request, as explained above, contains a request for aggregating a Secondary Cell (SCell), such as a local area cell, for a User Equipment (UE), such as a mobile device.[253] Thus, for the same reasons as my analysis for the [1b], Han teaches this claim element.

c) [7c]: receiving, by the second eNB, an accept message from the first eNB in response to the first request;

255. This claim element is the mirror image of claim 1, which recites "transmitting an accept message from the first eNB to the second eNB in response to the first request." This claim element recites "receiving" that accept message

[252] *See, e.g.*, Section VIII(C)(2)(b).

[253] *See, e.g.*, Section VIII(C)(2)(b).

from "a first eNB." In my opinion, Han teaches this limitation for the same reasons in my analysis of [1c] above, which I incorporate by reference here.[254]

256. As I describe above, Han teaches, in connection with the dual connectivity technology detailed in the reference, that the LAAP (which is the first eNB of the '883 patent claims) sends a Dual Connection Setup Response to the MAP (which is the second eNB of the '883 patent claims).[255] That message is accept message, as I detail above.[256] Thus, for the same reasons as my analysis for the [1c], Han teaches this claim element.[257]

> *d) [7d]: receiving, by the second eNB which controls a Primary Cell (PCell) of the UE, a second request from the first eNB which controls the SCell of the UE; and changing a data path for a first radio bearer of the UE and not changing a data path for a third radio bearer of the UE based on the second request;*

257. This claim element is the mirror image of claim 1, which recites "transmitting a second request from the first eNB, which controls the SCell of the

[254] *See, e.g.*, Section VIII(C)(2)(c).

[255] *See, e.g.*, Section VIII(C)(2)(c).

[256] *See, e.g.*, Section VIII(C)(2)(c).

[257] *See, e.g.*, Section VIII(C)(2)(c).

UE, to the second eNB, which controls a Primary Cell (PCell) of the UE, to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE." This limitation recites "receiving" the second request by a second eNB and "changing a data path for a first radio bearer of the UE and not changing a data path for a third radio bearer of the UE based on the second request." In my opinion, Han teaches this limitation or, at a minimum, renders obvious this claim for the same reasons in my analysis of Element [1d] above, which I incorporate by reference here.[258]

258. As I explain in Section [1d] there are multiple messages that meet the "second request" of the '883 patent claims, including the Dual Connection Setup Request, Dual Connection Setup Response, and the Path Switch and Suspend Request for split bears to Dual Connection Establish Complete message that propagates through the core network.[259] These messages meet the "second request" of claim 1 (which is "to change a data path for a first radio bearer of the UE, wherein the second request does not indicate to change the data path for a third radio bearer of the UE") as well as this claim ("changing a data path for a first radio bearer of the

[258] *See, e.g.*, Section VIII(C)(2)(d).

[259] *See, e.g.*, Section VIII(C)(2)(d).

UE and not changing a data path for a third radio bearer of the UE based on the second request").[260]

259. As I detail above, Han teaches that these identified "second requests" are to change a data path and the data path for a first radio bearer (*e.g.*, a bearer contained in the split bearer information elements above for bearers that are handed over) and not change the data path for a third radio bearer (*e.g.*, a bearer not contained in the in split bearer information elements).[261]

260. In addition, as I detail above, the data path for a first radio bearer (*e.g.*, a bearer that is moved over) is changed based on each of the "second request" messages I identify above; likewise, the data path for a third radio bearer (*e.g.*, a bearer that is not handed over) is not changed based on each of the "second request" messages I identify above.[262]

261. In my opinion, each of the "second request" messages I identify in connection with 1[d] are received by the second eNB (the MAP). The messages are

[260] *See, e.g.*, Section VIII(C)(2)(d).

[261] *See, e.g.*, Section VIII(C)(2)(d).

[262] *See, e.g.*, Section VIII(C)(2)(d).

all received by MAP from the LAAP, as I detail above.[263] Thus, for the same reasons as my analysis for the [1c], Han teaches this claim element.[264]

e) [7e]: wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer.

262. This claim element recites the same claim language as [1e] above: "wherein a first path is via the first eNB and used as the data path for the first radio bearer and the third radio bearer before changing the data path for the first radio bearer." In my opinion, Han teaches this limitation for the same reasons in my analysis of [1e] above, which I incorporate by reference here.[265]

9) Claim 8

a) [Preamble]: The method of claim 7, wherein

263. In my opinion, for the reasons above, Han anticipates claim 7 of the '883 patent.

[263] *See, e.g.*, Section VIII(C)(2)(d).

[264] *See, e.g.*, Section VIII(C)(2)(d).

[265] *See, e.g.*, Section VIII(C)(2)(e).

b) [8b]: the data path for the first radio bearer is changed to a second path, wherein the second path is via the second eNB and used as a data path for a second radio bearer of the UE.

264. This claim element is the same as Element [2b]: "the data path for the first radio bearer is changed to a second path, wherein the second path is via the second eNB and used as a data path for a second radio bearer of the UE." In my opinion, Han teaches this limitation for the same reasons in my analysis of Element [2b] above, which I incorporate by reference here.[266]

10) Claim 9

a) [Preamble]: The method of claim 7, further comprising:

265. In my opinion, for the reasons above, Han anticipates or renders obvious claim 7 of the '883 patent.

b) [9b]: transmitting a confirmation message from the second eNB to the first eNB for changing the data path for the first radio bearer.

266. This claim element is the same as [5b] but recites "transmitting a confirmation message" instead of "receiving a confirmation message": "receiving, by the first eNB, a confirmation message from the second eNB for changing the data path for the first radio bearer."

[266] *See, e.g.*, Section Section VIII(C)(3).

267. In my opinion, Han teaches this limitation for the same reasons in my analysis of [5b] above, which I incorporate by reference here.[267] As I describe above, the LAP receives a confirmation message from the MAP for changing the data path of the first radio bearer.[268] The MAP (the second eNB of the '883 patent claims) transmits that message to the LAP (the first eNB of the '883 patent claims), as I describe above.[269]

11) Claim 10

a) [Preamble]: The method of claim 7, wherein

268. In my opinion, for the reasons above, Han anticipates or renders obvious claim 7 of the '883 patent.

b) [10b]: the UE has multiple paths via different eNBs after the data path for the first radio bearer change.

269. This claim element is the same as [4b]: "wherein the UE has multiple paths via different eNBs after the data path for the first radio bearer change." In my

[267] *See, e.g.*, Section VIII(C)(6).

[268] *See, e.g.*, Section VIII(C)(6).

[269] *See, e.g.*, Section VIII(C)(6).

opinion, Han teaches this limitation for the same reasons in my analysis of [4b] above, which I incorporate by reference here.[270]

12) Claim 11

a) [Preamble]: The method of claim 7, wherein

270. In my opinion, for the reasons above, Han anticipates claim 7 of the '883 patent.

b) [11b]: the second request comprises information about loading status of a cell controlled by the first eNB.

271. This claim element is the same as [6b]: "wherein the second request comprises information about loading status of a cell controlled by the first eNB." In my opinion, Han teaches this limitation for the same reasons in my analysis of [6b] above, which I incorporate by reference here.[271]

[270] *See, e.g.*, Section VIII(C)(5).

[271] *See, e.g.*, Section VIII(C)(5).

D. Ground 4: Han Renders Obvious Each of the Challenged Claims

1) Motivation to Modify Han

a) Path Switch and Suspend Request For Split Bearers to Dual Connection Establish Complete

272. To the extent the Path Switch and Suspend Request to Dual Connection Establish Complete message the LAAP provided initially through the core network) is not considered "from the first eNB ... to the second eNB" ([1e] and [7e] (similar)), a POSITA would have been motivated to exclusively use X2 for this message.

273. Before the '883 patent, it was known to exchange requests over X2 (including in Han).[272] Exclusively using X2 would reduce the network components needed to forward messages to an eNB. This would reduce the network's processing load and the potential for error. Using X2 would also speed up the network, *e.g.*, the message would not need to pass through the core network. And it would allow the network to scale without potentially overloading the core network or expanding the amount of core network components.

274. A POSITA would have further found that using X2 instead of S1 would have a reasonable expectation of success. The '883 patent describes the two options

[272] *See, e.g.*, Ex-1007, [0029], [0034], [0040].

as interchangeable.[273] Han also teaches, when setting up the dual connection, the eNBs and UE handle the cell reconfiguration, forwarding data, and synchronization without the core network's involvement.[274] A POSITA would thus expect communicating exclusively through X2 would work. And none of the references, or the '883 patent, express difficultly that would result from exclusively using X2. I am also not aware of any difficulty having the Path Switch and Suspend Request to Dual Connection Establish Complete be transmitted over X2 instead of S1 in light of the disclosure in Han.

275. Indeed, the '883 patent discloses both sending the path switch request directly to the eNB or through the core network, which indicates to a POSITA that the '883 patent claims cover both scenarios. There is also nothing in the '883 patent that indicates that sending the message directly to the eNB or through the core network was inventive or novel, which is consistent with my opinion that, at a minimum, sending the Path Switch and Suspend message directly to the eNB over X2 would have been obvious to a POSITA.

[273] *See, e.g.*, Ex-1001 at 7:18–25.

[274] *See, e.g.*, Ex-1007, Fig. 4 (steps 406–410).

b) Dual Connection Setup Response and Dual Connection Setup Request

276. To the extent the Dual Connection Setup Response and Dual Connection Setup Request are not "request[s] . . . to change a data path" ([1d], [7e] (similar)), a POSITA would have been motivated to modify these messages to request to change the data path (and then change the data path based on these messages). The messages include the bearers whose data paths change. In that scenario, the MAP, in addition to changing the DL allocation at the UE, could also release its resources for bearers (rather than wait for the Dual Connection Establishment Complete or the end marker from the core network). A POSITA would be motivated to make this change to simplify the system and reduce the number of messages exchanged between the eNBs and the core network for the same reasons as above. A POSITA would also have recognized that this change would not have impacted the selective handover system because cells and downlink data path would have already changed at the UE. A POSITA would thus have a reasonable expectation of success for the same reasons as above.

c) Cause For Data Path Changing and Loading Status

277. To the extent the "second requests" above ([1d] and [7d]) do not include "a cause for data path changing" ([3b]) or "information about loading status of a cell controlled by the first eNB" ([6b] and [11b]), a POSITA would have been motivated to modify Han to include that information. Han discloses that the eNBs track both

sets of data.[275] Including that data in the second request would make the system more efficient by informing the MAP (and the core network) of the network conditions in connection with the data-path change. This would assist the system with subsequent handovers based on network conditions. In addition, this approach would reduce the number of messages transmitted through the network, which increases speed and reduces the potential for error.

278. A POSITA would have had a reasonable expectation of success. The "second requests" already include the information elements to carry this data (*e.g.*, Quality of Service profiles).[276] A POSITA would thus understand that the modification would simply require taking data Han already tracks and including it in an existing message field. This is a small, trivial change, if any, to the existing message structure and processing system in Han.

2) Independent Claims

279. Han renders obvious claims 1 and 7. Han discloses each element of these claims. To the extent Han does not disclose [1d] and [7d], it would have been obvious to modify the system for the reasons above to meet those limitations. *Id.*

[275] *See, e.g.*, Ex-1007, [0033].

[276] *See, e.g.*, Ex-1007, [0040].

First, it would have been obvious to have the LAAP send the Path Switch and Suspend Request message to the MAAP over X2 instead of through the core network (over S1). Second, it would have been obvious to modify the Dual Connection Setup Response and subsequent Dual Connection Setup Requests to include the same elements as the Path Switch and Suspend Request. Any of these modifications would have met [1d] and [7d]. The Path Switch and Suspend Request For Split Bearers to Dual Connection Establish Complete would undisputedly be from the Source eNB to the Target eNB without any intervening components as a conduit. The Dual Connection Setup Response and Dual Connection Setup Request would also undisputedly contain requests to change the data path.

3) Dependent Claims

280. Han also renders obvious claims 2–6 and 8–11. Han discloses each element of these claims. To the extent Han does not disclose [3b], it would have been obvious to a POSITA to modify Han to meet that element (*e.g.*, include the dual-connection cause in a "second request") based on the motivations above. To the extent Han does not disclose element [6b] and [11b], it would have been obvious to a POSITA to modify the system to meet that element (*e.g.*, include loading status information in a "second request" based on the motivations above.

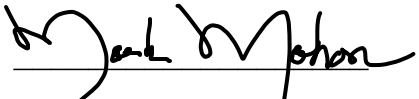
IX. SECONDARY CONSIDERATIONS

281. At this time, I am unaware of any evidence of secondary considerations that would support a finding of non-obviousness. The asserted prior art cited herein demonstrates there is no evidence of failure by others and that the features recited in the Challenged Claims were readily available in the prior art. Thus, at this stage, it is my opinion that there are no secondary considerations that weigh against my conclusion that the Challenged Claims would have been obvious to a POSITA.

X. CONCLUSION

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

Dated: Mark Mahon, Ph.D.

By: 

Mark Mahon, Ph.D.