UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

PANTECH CORPORATION,
Patent Owner

IPR2025-00637
U.S. Patent No. 9,763,283

DECLARATION OF DR. ROBERT AKL IN SUPPORT OF PETITION FOR *INTER PARTES REVIEW* OF U.S. PATENT 9,763,283

Contents

I, Robert Akl, D.Sc. of Dallas, Texas, declare that:

I. Introduction

1. My name is Robert Akl, and I have been retained by counsel for Petitioner OnePlus Technology (Shenzhen) Co., Ltd. ("OnePlus" or "Petitioner") as an expert witness to provide assistance regarding U.S. Patent No. 9,763,283 (also referred to herein as "the '283 Patent") currently assigned to Pantech Corporation ("Pantech" or "Patent Owner"). Specifically, I have been asked to consider the validity of claims 1-13 of the '283 Patent (the "Challenged Claims") in view of prior art, anticipation, and obviousness considerations, and understanding of a person of ordinary skill in the art at the time of the invention ("POSITA") as it relates to the '283 Patent. I have personal knowledge of the facts and opinions set forth in this declaration and believe them to be true. If called upon to do so, I would testify competently thereto.

2. I am being compensated for my time at my standard consulting rate. I am also being reimbursed for expenses that I incur during the course of this work. My compensation is not contingent upon the results of my study, the substance of my opinions, or the outcome of any proceeding involving the challenged claims. I have no financial interest in the outcome of this matter.

3. My analysis here is based on my years of education, research, and experience, as well as my investigation and study of relevant materials, including

those cited herein.

4. I may rely upon these materials, my knowledge and experience, and/or additional materials to rebut arguments raised by the Patent Owner. Further, I may also consider additional documents and information in forming any necessary opinions, including documents that may not yet have been provided to me.

5. My analysis of the materials produced in this proceeding is ongoing, and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis of the materials provided.

II. Background and Qualifications

6. I am an expert in the field of wireless communication systems. I have studied, taught, practiced, and researched this field for over 30 years. I have summarized in this section my educational background, work experience, and other relevant qualifications. Attached hereto as Appendix A is a true and correct copy of my *curriculum vitae* describing my background and experience.

7. I earned my Bachelor of Science degrees in Electrical Engineering and Computer Science *summa cum laude* with a grade point average of 4.0/4.0 and a ranking of first in my undergraduate class from Washington University in St. Louis in 1994. In 1996, I earned my Master of Science degree in Electrical Engineering

from Washington University in St. Louis with a grade point average of 4.0/4.0. I earned my Doctor of Science in Electrical Engineering from Washington University in St. Louis in 2000, again with a grade point average of 4.0/4.0, with my dissertation being on "Cell Design to Maximize Capacity in Cellular Code Division Multiple Access (CDMA) Networks."

8. While a graduate student, from 1997 through 1999, I worked at MinMax Corporation in St. Louis, where I designed software packages that provided tools to flexibly allocate capacity in a CDMA communications network and maximize the number of subscribers. I also validated the hardware architecture for an Asynchronous Transfer Mode (ATM) switch capable of channel group switching, as well as performed logical and timing simulations, and developed the hardware architecture for the ATM switch. I also worked with Teleware Corporation in Seoul, South Korea, where I designed and developed algorithms that were commercially deployed in a software package suite for analyzing the capacity in a CDMA network implementing the IS-95 standard to maximize the number of subscribers.

9. After obtaining my Doctor of Science degree, I worked as a Senior Systems Engineer at Comspace Corporation from October of 2000 to December of 2001. At Comspace, I designed and developed advanced data coding and modulation methods for improving the reliability and increasing the available data rates for cellular communications. I coded and simulated different encoding schemes

(including Turbo coding, Viterbi decoding, trellis coded modulation, and Reed-Muller codes) and modulation techniques using amplitude and phase characteristics and multi-level star constellations. This work further entailed the optimization of soft decision parameters and interleavers for additive white Gaussian and Rayleigh faded channels. In addition, I also extended the control and trunking of Logic Trunked Radio (LTR) to include one-to-one and one-to-many voice and data messaging.

10. In January of 2002, I joined the faculty of the University of New Orleans in Louisiana as an Assistant Professor in the Department of Electrical Engineering. While in this position, I designed and taught two new courses called "Computer Systems Design I and II." I also developed a Computer Engineering Curriculum with a strong hardware-design emphasis, formed a wireless research group, and advised graduate and undergraduate students.

11. In September of 2002, I received an appointment as an Assistant Professor in the Department of Computer Science and Engineering at the University of North Texas (UNT), in Denton, Texas. In May of 2008, I earned tenure and was promoted to the rank of Associate Professor. As a faculty member, I have taught courses and directed research in networking and telecommunications, including 2G, 3G, 4G, 5G, CDMA/WCDMA, GPS, GSM, UMTS, LTE, ad-hoc networks, antenna design and beamforming, Bluetooth, call admission control, channel coding, channel

estimation, communication interfaces and standards, compression, computer architecture, fault recovery, link aggregation, Internet Protocols, MIMO systems, multi-cell network optimization, network routing, network security, network self-test, packet-networks, ring-networks, routing, telephony, VoIP, VPLS, Wi-Fi (802.11), 802.15.4, Zigbee, wireless communication, and wireless sensors. Between January of 2015 and August of 2022, I was appointed to Associate Chair of Graduate Studies in the Department of Computer Science and Engineering. In May of 2023, I was promoted to the rank of Professor.

12. I am also the director of the Wireless Sensor Lab ("WiSL") at UNT. I am a member of the Center for Information and Cyber Security (CICS). It is the only program in the U.S. to be federally certified by the National Security Agency as a Center of Academic Excellence in Information Assurance Education and Research and Cyber Defense Research. I was also a member of the NSF Net-Centric & Cloud Software & Systems: Industry-University Cooperative Research Center (I/UCRC). Several of my research projects are funded by industry and the National Science Foundation and published in *IEEE* conference proceedings and journals.

13. In addition to advising and mentoring students at UNT, I was asked to join the faculty of the University of Arkansas in Little Rock as an Adjunct Assistant Professor from 2004 to 2008 in order to supervise the research of two Ph.D. graduate students who were doing research in wireless communications. At UNT, I have

advised and supervised more than 250 undergraduate and graduate students, several of whom received a master's or doctorate degree under my guidance.

14. Further, between 2005 and 2017, I have received over a million dollars in funding from the State of Texas, Texas Higher Education Coordination Board, the National Science Foundation, and industry to design and conduct robotics, video, and mobile gaming (*e.g.*, Xbox, PC, mobile device) programming summer camps for middle and high school students at UNT. By using video and mobile gaming as the backdrop, participants have learned coding and programming principles and developed an understanding of the role of physics and mathematics in video game design. I have used competitive gaming projects in programming courses as a way to motivate and retain students in computer science.

15. Between 2011 and 2013, I was director of the Bio-Com Project that was funded by Raytheon. The project evaluated the feasibility study using Surface Electromyography (EMG) and bend resistive sensors, that are attached to each of the five fingers of the hand, for hand gesture recognition. This approach is sometimes known as a "data glove." A prototype was developed and demonstrated at Raytheon, to help soldiers in close-combat situations communicate with hand gestures and hand signals that would be recognized and transmitted to other soldiers' Head Up Display (HUD) without breaking radio silence.

16. In addition to my academic work, I have remained active in the

communication industry through my consulting work. In 2002, I consulted for Input/Output Inc. and designed and implemented algorithms for optimizing the frequency selection process used by sonar for scanning the bottom of the ocean. In 2004, I worked with Allegiant Integrated Solutions in Ft. Worth, Texas, to design and develop an integrated set of tools for fast deployment of wireless networks, using the IEEE 802.11 standard. Among other features, these tools optimize the placement of Access Points and determine their respective channel allocations to minimize interference and maximize capacity. I also assisted the Collin County Sheriff's Office (Texas) in a double homicide investigation, analyzing cellular record data to determine user location.

17. I have authored and co-authored over 100 journal publications, conference proceedings, technical papers, book chapters, and technical presentations in a broad array of communications-related technologies, including networking and wireless communication. I have also developed and taught over 100 courses related to communications and computer systems, switches and routers, including several courses on signals and systems, 4G/LTE and 5G/NR, OFDM, Internet Protocols, VoIP, VPLS, Wi-Fi (802.11), 802.15.4, Zigbee, wireless communication, antenna design and beamforming, communications systems, communication interfaces and standards, channel estimation, fault recovery, link aggregation, location management, sensor networks, source coding and compression, network security,

network self-test, computer systems design, game and app design, and computer architecture. These courses have included introductory courses on communication networks and signals and systems, as well as more advanced courses on wireless communications, networking and routing. A complete list of my publications and the courses I have developed and/or taught is also contained in my *curriculum vitae*.

18. My professional affiliations include services in various professional organizations and serving as a reviewer for a number of technical publications, journals, and conferences. I have also received a number of awards and recognitions, including the *IEEE* Professionalism Award (2008), UNT College of Engineering Outstanding Teacher Award (2008), and Tech Titan of the Future (2010), among others, which are listed in my *curriculum vitae*.

19. I have also served as an expert in certain legal proceedings. A list of cases in which I have testified at trial, hearing, or by deposition (including those during the past five years) is provided in my *curriculum vitae*. Over the years, I have been retained by both patent owners and petitioners, as well as plaintiffs and defendants.

III. Level of Ordinary Skill in the Art

20. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a POSITA at the time of the alleged invention, which I understand is asserted to be April 5, 2013—the

alleged priority date of the patent application. I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field, the types of problems encountered in the field, the teachings of the prior art, and the sophistication of the technology at the time of the alleged invention. I understand that a POSITA is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a POSITA would also have knowledge from the teachings of the prior art, including the art cited below.

21. Taking these factors into consideration, on or before April 5, 2013, a POSITA of the '283 Patent would have had a Bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and two to three years of experience in the design or development of telecommunication systems, or the equivalent. Additional graduate education could substitute for professional experience, or significant professional experience in the field could substitute for formal education.

22. Before April 5, 2013, my level of skill in the art was at least that of a POSITA. I am qualified to provide opinions concerning what a POSITA would have known and understood at that time, and my analysis and conclusions herein are from the perspective of a POSITA as of that date.

IV. Materials Considered and Relied Upon

23. In reaching the conclusions described in this declaration, I have relied on the documents and materials cited herein as well as those identified in this Declaration, including but not limited to, the '283 Patent, the prosecution history of the '283 Patent, and prior art references cited herein. These materials include patents, related documents, and printed publications. Each of these materials is a type of document that experts in my field would have reasonably relied upon when forming their opinions.

24. In the cited references, all emphasis is added unless otherwise noted.

25. I have also relied on my education, training, research, knowledge, and personal and professional experience in the relevant technologies and systems that were already in use prior to, and within the timeframe of the assumed priority date of the claimed subject matter in the '283 Patent, which is April 5, 2013.

- EX1001: U.S. Patent No. 9,763,283 to Jung *et al*. ("the '283 Patent")
- EX1002: Prosecution History of U.S. Patent No. 9,763,283 ("the prosecution history")
- EX1004: U.S. Patent No. 10,631,222 to Dudda *et al*. ("Dudda")
- EX1005: U.S. Provisional Application No. 61/754,322 in the name of Dudda *et al*. ("Dudda-prov")
- EX1006: International Patent Application Publication No. 2014/110813 in the name of Lin *et al*. ("Lin")

- EX1007: U.S. Patent Application Publication No. 2011/0134774 in the name of Pelletier *et al.* ("Pelletier")
- EX1008: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (3GPP TS 36.213 version 11.0.0 Release 11)," ETSI TS 136 213 V11.0.0 (2012-10), available at https://www.etsi.org/deliver/etsi_ts/136200_136299/136213/11.00.00_60/ts_136213v110000p.pdf ("TS36.213")
- EX1009: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (3GPP TS 36.300 version 11.3.0 Release 11)," ETSI TS 136 300 V11.3.0 (2012-11), available at https://www.etsi.org/deliver/etsi_ts/136300_136399/136300/11.03.00_60/ts_136300v110300p.pdf ("TS36.300")
- EX1010: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification (3GPP TS 36.321 version 11.0.0 Release 11)," ETSI TS 136 321 V11.0.0 (2012-10), available at https://www.etsi.org/deliver/etsi_ts/136300_136399/136321/11.00.00_60/ts_136321v110000p.pdf ("TS36.321")
- EX1011: E. Dahlman *et al*., "4G LTE/LTE Advanced for Mobile Broadband," 1st ed. Elsevier, 2011 ("Dahlman")
- EX1012: U.S. Patent No. 9,814,075 to Kim *et al.* ("Kim")
- EX1013: U.S. Patent Application Publication No. 2012/0281548 in the name of Lin *et al*. ("Lin-548")
- EX1014: U.S. Patent Application Publication No. 2013/0028069 in the name of Pelletier *et al*. ("Pelletier-069")

- EX1015: U.S. Patent No. 9,118,452 to Park *et al.* ("Park")
- EX1017: A. Atayero, *et al.*, "3GPP Long Term Evolution: Architecture, Protocols and Interfaces," International Journal of Information and Communication Technology Research, Volume 1, No. 7, November 2011, ("Atayero")

V. Legal Standards

26. I am not a lawyer and do not provide any legal opinions, but I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims. I have applied the legal standards described below, which were provided to me by counsel for the Petitioner.

27. It is my understanding that assessing the validity of a U.S. patent based on a prior art analysis requires two steps. First, one must construe the terms of the patent claims to understand what meaning a POSITA would have given the terms. Second, after the claim terms have been construed, one may then assess validity by comparing a patent claim to the "prior art." I understand that the teaching of the prior art is viewed through the eyes of a POSITA at the time the invention was made. My analysis as to what constitutes a POSITA is set forth above.

A. Claim Construction

28. I have been informed that patent claims are construed from the

viewpoint of a POSITA of the patent at the time of the invention. I have been informed that patent claims generally should be interpreted consistent with their plain and ordinary meaning as understood by a POSITA in the relevant time period (*i.e.*, at the time of the purported invention, or the so-called "effective filing date" of the patent application), after reviewing the patent claim language, the specification, and the prosecution history (collectively, the intrinsic record).

29. I have further been informed that a POSITA must read the claim terms in the context of the claim itself, as well as in the context of the entire patent specification. I understand that in the specification and prosecution history, the patentee may specifically define a claim term in a way that differs from the plain and ordinary meaning. I understand that the prosecution history of the patent is a record of the proceedings before the U.S. Patent and Trademark Office and may contain explicit representations or definitions made during prosecution that affect the scope of the patent claims. I understand that an applicant may, during the course of prosecuting the patent application, limit the scope of the claims to overcome prior art or to overcome an examiner's rejection, by clearly and unambiguously arguing to overcome or distinguish a prior art reference, or clearly and unambiguously disavowing claim coverage.

30. In interpreting the meaning of the claim language, I understand that a POSITA may also consider "extrinsic" evidence, including expert testimony,

inventor testimony, dictionaries, technical treatises, other patents, and scholarly publications. I understand this evidence is considered to ensure that a claim is construed in a way that is consistent with the understanding of a POSITA at the time of the invention. For example, this can be useful for a technical term whose meaning may differ from its ordinary English meaning. I understand that extrinsic evidence may not be relied on if it contradicts or varies the meaning of claim language provided by the intrinsic evidence, particularly if the applicant has explicitly defined a term in the intrinsic record.

B. Anticipation

31. I understand that a patent claim is invalid as "anticipated" if each and every limitation of the claim is found, either expressly or inherently, in a single device or method that predates the claimed invention or is described in a single previous publication or patent that predates the claimed invention. I understand that, in patent law, these previous devices, methods, publications, or patents are called "prior art." I understand that in order to anticipate a claim, a prior art reference must do more than merely disclose each element of the claim, but rather the prior art reference must disclose all of the elements of the claimed invention arranged as is recited by the claim. I also understand that in order for a prior art reference to anticipate a claim of a patent, the reference must enable a POSITA at the time of the invention to practice the claim without undue experimentation.

32. I also understand that a prior art reference can disclose a claimed feature because the feature is expressly described or because the feature is inherent in the disclosure. I understand that something is inherent in a prior art reference if the missing descriptive matter must necessarily be present, not merely probably or possibly present, and it would be so recognized by a POSITA as of the priority date of the patent. I understand that it is acceptable to examine evidence outside of the prior art reference (*i.e.*, extrinsic evidence) in determining whether a feature, while not expressly discussed in the reference, is necessarily present in it.

33. I have further been informed that where a reference discloses multiple embodiments, the reference should not be limited to a preferred embodiment. Instead, each disclosed embodiment may anticipate.

34. Moreover, I have been informed that as part of an anticipation analysis, it is proper to take into account not only specific teachings of the reference, but also the inferences that a POSITA would reasonably be expected to draw therefrom. A reference can anticipate a claim even if it does not expressly spell out all the limitations arranged or combined as in the claim, if a POSITA, reading the reference, would envisage the claimed arrangement or combination.

C. Obviousness

35. I understand that a claim may be invalid if the subject matter described by the claim as a whole would have been obvious to a hypothetical POSITA in view

of a prior art reference or in view of a combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical POSITA and that the asserted claims of the patent should be read from the point of view of such a person at the time the claimed invention was made. I further understand that a hypothetical POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit.

36. I have been informed that there are two criteria for determining whether prior art is analogous and thus can be considered prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the patentee's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the patentee is involved. I have also been informed that the field of endeavor of a patent is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field. I have also been informed that a reference is reasonably pertinent if, even though it may be in a different field from that of the patentee's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to a patentee's attention in considering their problem.

37. I have also been advised that an analysis of whether a claimed invention

would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole.

38. I have also been advised that in considering whether a claimed invention would have been obvious over a combination of prior art references, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a POSITA. I understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yielding predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a POSITA can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a POSITA would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond their skill;

- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls whether the claim is obvious;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a POSITA will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A POSITA is also a person of ordinary creativity, and is not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a POSITA would have had good reason to pursue the known options within his or her technical grasp; and

- One should be cautious of using hindsight in evaluating whether a claimed invention would have been obvious.

39. I further understand that, in making a determination as to whether the claimed invention would have been obvious to a POSITA, the Patent Trial and Appeal (PTAB) Board may consider certain objective factors if they are present, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as "secondary considerations" or "objective indicia" of nonobviousness. I understand, however, that for such objective evidence to be relevant to the obviousness of a claim, there must be a causal relationship (called a "nexus") between the claim and the evidence, and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

VI. Technology Background

A. Cellular Radio Systems

40. Conceptually, all cellular radio systems can be described at a high level in terms of user equipment devices, air interface standards, base station systems, core networks, and linkages to external networks.

41. User equipment devices communicate exclusively with elements of the base station systems that are in their geographic vicinity over a radio communications channel using various air interface standards. Air interface standards for cellular radio systems have evolved dramatically over the past 30 years, and new standards are still emerging. A modern historical view of air interface standards groups them according to successive "generations" of technology, where today, "5th generation" (5G) standards are becoming prevalent, especially for cellular data networking. The two most common forms of "user equipment" (UE) are the voice handset (cellphone), which engineers usually refer to as a "mobile station" (MS), and the data-networking terminal, which engineers often refer to as an "access terminal" (AT, although this is often called an MS as well in many documents). So-called "smart phones" are effectively a combined MS and AT in a single physical device. Also, an MS is not restricted to being only a voice handset–for example, telemetry devices may be implemented as an MS with only "short message service" (SMS) or "multimedia message service" (MMS) capability to communicate with a remote host–and further, some non-voice call related attributes of a voice handset MS may be retained in an AT.

1. 3G

42. The 3G mobile networks were introduced in the early 2000s and were based on Global System for Mobile Communications (GSM) and Code-Division

Multiple Access (CDMA). These systems offered web browsing on mobile phones along with voice, SMS, and MMS services. 3G systems included Universal Mobile Telecommunication Systems (UMTS) and wideband-CDMA (WCDMA). Smartphones became popular in the mid-2000s. 3G networks provided data rates upward of 384 Kbps, but they required large bandwidth and complex infrastructure.

43. Due to continuous demand for higher data rates, High-Speed Downlink Packet Access (HSDPA), High-Speed Uplink Packet Access (HSUPA), and High-Speed Packet Access (HSPA+) were introduced in 3G networks to increase data rates. These types of networks were referred to as 3.5G or $3G^{+}$ networks, and they provided data rates up to 2 Mbps. It allows networks based on the 3G UMTS to have higher data speeds and capacity.

2. 4G/LTE

44. By the late 2000s timeframe, as the 3G systems became pervasive in coverage and "smartphones" and "tablets" were becoming commonplace as "always-on" Internet-connected mobile devices, engineers were now developing and, especially in the United States, starting trial deployments of "4^{th} generation" (4G) cellular radio systems. The fundamental subscriber benefit of 4G is much more robust packet data networking support at even higher data rates of 100 Mb/s or more as the network infrastructure was successively upgraded over the next several years, which enabled wirelessly connected devices such as laptop computers to run

Internet-based applications with user experience similar to the now much faster wired broadband services available, as compared to 10 years earlier.

45. Three competing 4G standards efforts emerged. One of these standards efforts was started by 3GPP2 as an evolution of CDMA2000 into a 4G standard called "Ultra Mobile Broadband" (UMB). However, no cellular operators have deployed UMB, and efforts on it are now largely abandoned. A second standards effort for 4G was the IEEE 802.16 committee, and a few cellular operators (like Sprint and Clearwire) in the United States and elsewhere have deployed IEEE 802.16e (also known as "WiMAX") mobile networks that use the Internet Protocol (IP)-based core network of all IEEE 802 standards and physical (PHY) layers based on Orthogonal Frequency Division Multiplexing (OFDM) for superior performance compared to CDMA-based PHY layers. The third major 4G standards effort is led by 3GPP and is called "Long Term Evolution" (LTE). Every major US-based cellular operator has made a commitment to LTE, and all of the United States already has LTE service, and WiMAX was abandoned in favor of LTE. LTE has an "Evolved Packet Core" (EPC) that is mostly IP-based but with excellent interoperability to 3G UMTS core networks. LTE uses PHY layers based on OFDM with many aspects in common with the PHY layers of IEEE 802.16e.

46. LTE is one standard developed by organizations from all over the world. There were nearly 83,000 submissions to the 3rd Generation Partnership Project

(3GPP) over a six-year period (April 2005 through February 2011). At least 104 companies had submitted contributions to the 3GPP standardization process during the timeframe of the review.

47. LTE has been playing a key role in the adoption of 4G since it was commercially launched in early 2010. In a matter of a few years, LTE has been successfully deployed around the world, driving the entire wireless ecosystem to connect over 1 in 4 mobile users worldwide, a trend that is continuing to grow tremendously. Many Mobile Network Operators (MNO) have heavily invested in the LTE network rollouts across the world for the transition from 2G/3G to 4G. This deployment has been an instrumental step to enhance the Mobile Broadband (MBB) proposition and improved coverage, as well as to offer more attractively priced data tariffs, greater availability, and affordability of higher-speed devices. The generational shift that is gaining momentum on the wave of the continuous enhancements and new features that the standard introduces has made LTE the fastest developing mobile technology ever. Statistics reflect that as of July 2017, 782 operators were invested in LTE across 200 countries, with up to 601 LTE networks commercially deployed and launched in 192 countries.

B. LTE System Architecture

48. The LTE network is based on Evolved Packet System (EPS). The LTE network architecture includes: (1) a user equipment (UE); (2) a Radio Access

Network (RAN) known as the Evolved Universal Terrestrial Radio Access Network (E-UTRAN); and (3) an IP core network known as the Evolved Packet Core (EPC). EX1017, § II, pp. 306-307, FIG. 1. An architecture of the LTE network is illustrated below in FIG. A. The E-UTRAN handles tasks that are related to radio functionality, such as coding, multi-antenna techniques, radio-resource handling, retransmissions handling, and scheduling. As shown in FIG. A, the E-UTRAN includes evolved Node Bs (eNBs) that are interconnected by the X2 interface.

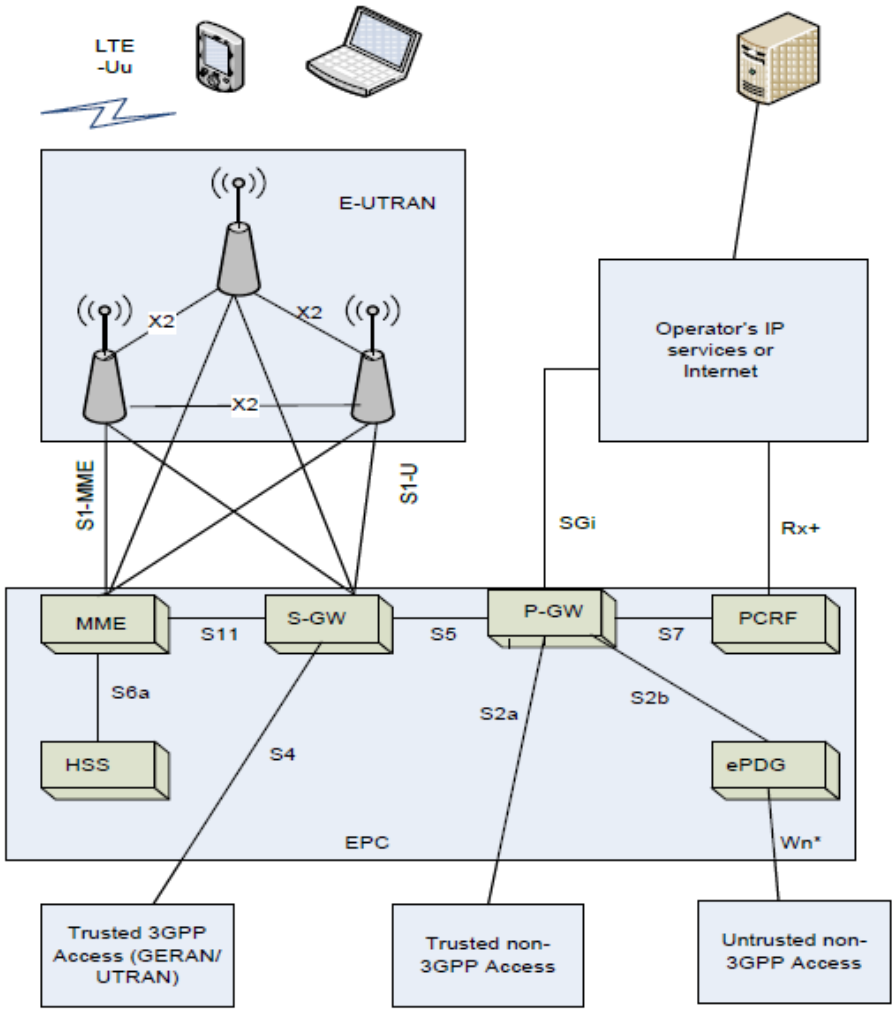


FIG. A – FIG. 1 of EX1017, Atayero

C. RAN Protocol Stack Layers

49. As shown in FIG. B below, RAN protocol stack layers include the following (EX1011, § 8.2, pp. 111-113):

- Packet Data Convergence Protocol (PDCP) layer performs IP header compression to reduce the number of bits to transmit over the radio interface. The header-compression mechanism is based on Robust Header Compression (ROHC), a standardized header-compression algorithm also used for several mobile-communication technologies. PDCP is also responsible for ciphering and, for the control plane, integrity protection of the transmitted data, as well as in-sequence delivery and duplicate removal for handover. At the receiver side, the PDCP protocol performs the corresponding deciphering and decompression operations. There is one PDCP entity per radio bearer configured for a terminal.
- Radio-Link Control (RLC) layer is responsible for segmentation/concatenation, retransmission handling, duplicate detection, and in-sequence delivery to higher layers. The RLC provides services to the PDCP.
- Medium-Access Control (MAC) layer handles multiplexing of logical channels, hybrid-ARQ retransmissions, and uplink and downlink scheduling. The scheduling functionality is located in the eNodeB for both uplink and

downlink. The hybrid-ARQ protocol part is present in both the transmitting and receiving ends of the MAC protocol. The MAC provides services to the RLC in the form of logical channels.

- Physical Layer (PHY) layer handles coding/decoding, modulation/demodulation, multi-antenna mapping, and other typical physical-layer functions. The physical layer offers services to the MAC layer in the form of transport channels.

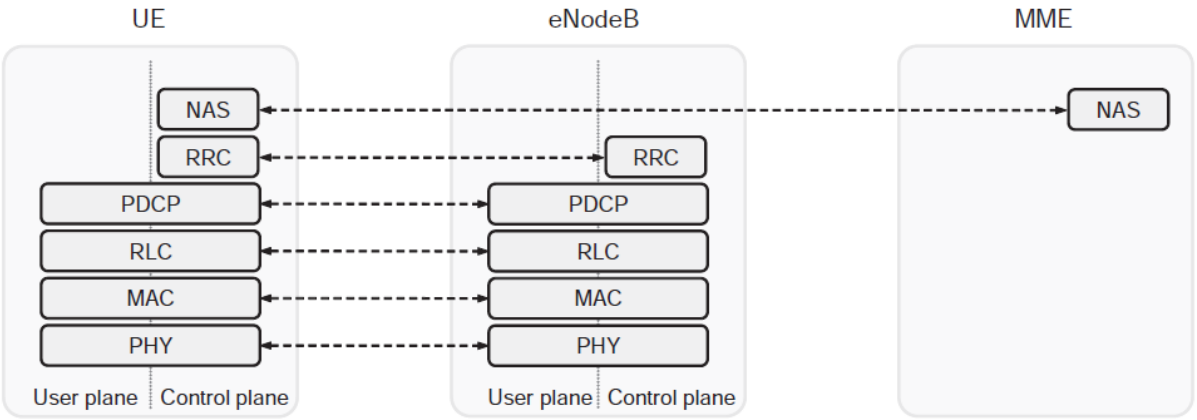


FIGURE 8.3

Overall RAN protocol architecture.

FIG. B – FIG. 8.3 of EX1011, Dahlman

50. To summarize the flow of downlink data through all the protocol layers, an example illustration for a case with three IP packets, two on one radio bearer and one on another radio bearer, is given in FIG. C below. The data flow in the case of uplink transmission is similar. The PDCP layer performs (optional) IP-header compression, followed by ciphering. A PDCP header is added, carrying information

required for deciphering in the terminal. The output from the PDCP is forwarded to the RLC layer. The RLC protocol performs concatenation and/or segmentation of the PDCP SDUs and adds an RLC header. The header is used for in-sequence delivery (per logical channel) in the terminal and for identification of RLC protocol data units (PDUs) in the case of retransmissions. The RLC PDUs are forwarded to the MAC layer, which multiplexes a number of RLC PDUs and attaches a MAC header to form a transport block. The transport-block size depends on the instantaneous data rate selected by the link-adaptation mechanism. Finally, the physical layer attaches a cyclic redundancy check (CRC) to the transport block for error-detection purposes, performs coding and modulation, and transmits the resulting signal, for example, using multiple transmit antennas. EX1011, § 8.2, pp. 113-114.

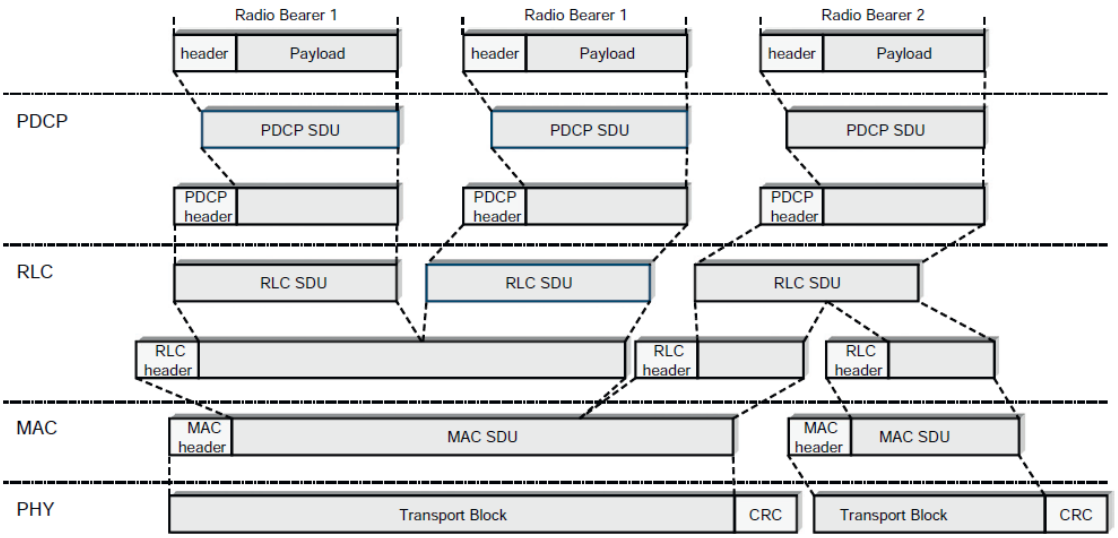


FIGURE 8.5

Example of LTE data flow.

FIG. C – FIG. 8.5 of EX1011, Dahlman

1. MAC Layer

51. Part of the MAC layer functionality is multiplexing of different logical channels and mapping of the logical channels to the appropriate transport channels. The logical channels include the Common Control Channel (CCCH) for transmission of control information in conjunction with random access, Dedicated Traffic Channel (DTCH) for transmission of user data to/from a terminal, and Dedicated Control Channel (DCCH for transmission of control information to/from a terminal. The Uplink Shared Channel (UL-SCH) is the uplink transport channel for transmission of uplink data. The supported mappings between logical-channel types and transport-channel types are given in FIG. D below for the uplink. The figure clearly indicates how UL-SCH is the main uplink transport channel. In the figure, the corresponding physical channels, including the Physical Downlink Shared Channel (PDSCH) and Physical Uplink Control Channel (PUCCH), are also included, and the mapping between transport channels and physical channels is illustrated. EX1011, § 8.2.2.1, pp. 116-118.

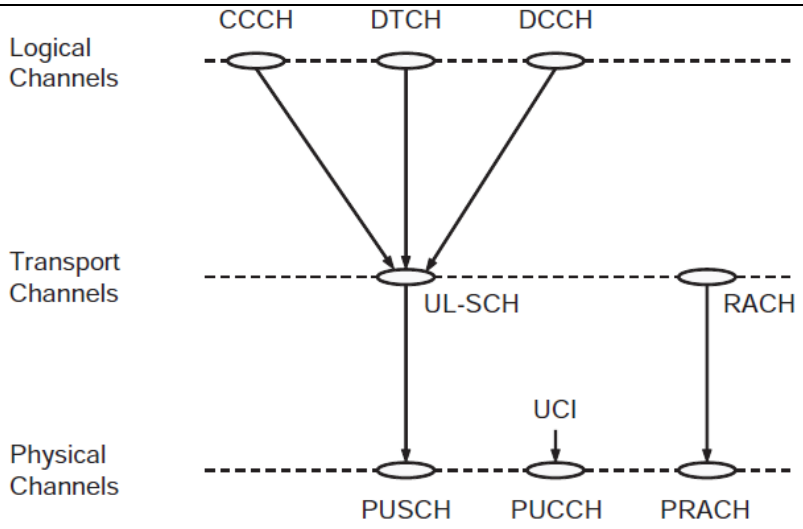


FIGURE 8.8

Uplink channel mapping.

FIG. D – FIG. 8.8 of EX1011, Dahlman

2. PHY Layer

52. The physical layer provides services to the MAC layer in the form of transport channels. A physical channel corresponds to the set of time–frequency resources used for transmission of a particular transport channel, and each transport channel is mapped to a corresponding physical channel, as shown in FIG. D above. For example, the PUSCH is used for uplink data transmission, but also for transmission of paging information. There is at most one PUSCH per uplink Component Carrier (CC) per terminal. The Physical Uplink Control Channel (PUCCH) is used by the terminal to send hybrid-ARQ acknowledgements, indicating to eNodeB whether the downlink transport block(s) was successfully received or not, to send channel-state reports aiding downlink channel-dependent

scheduling, and for requesting resources to transmit uplink data upon. There is at most one PUCCH per terminal. EX1011, § 8.2.3, pp. 123-124.

53. Sounding reference signals (SRS) are transmitted on the uplink to allow for the base station to estimate the uplink channel state at different frequencies to support uplink channel-dependent scheduling and link adaptation. The channel-state estimates can then, for example, be used by the network scheduler to assign resource blocks of instantaneously good quality for uplink PUSCH transmission (uplink channel-dependent scheduling), as well as to select different transmission parameters such as the instantaneous data rate and different parameters related to uplink multi-antenna transmission. SRS transmission can also be used for uplink timing estimation to control the uplink transmit timing by means of the uplink-timing-alignment procedure. EX1011, § 11.2, pp. 210, 217.

D. Dual Connectivity

54. Dual connectivity is a feature defined from the UE perspective wherein the UE may simultaneously receive and transmit to at least two different network points. EX1005, 4:18-19. Dual connectivity is one of the features that are being standardized within the umbrella work of small cell enhancements within 3GPP Release 12 (Rel-12). EX1005, 4:20-21. Dual connectivity is defined as the case when the aggregated network points operate on the same or separate frequency. EX1005, 4:23-24. Dual connectivity provides a host of benefits, including "Radio

Link Failure (RLF robustness (failure only when both links fail)." EX1005, 5:8-18.

55. Examples of dual connectivity include FIG. 3 of Dudda-prov (shown as FIG. E below), which depicts "[a] UE in dual connectivity [which] maintains simultaneous connections to anchor and booster nodes." EX1005, 5:20-23.

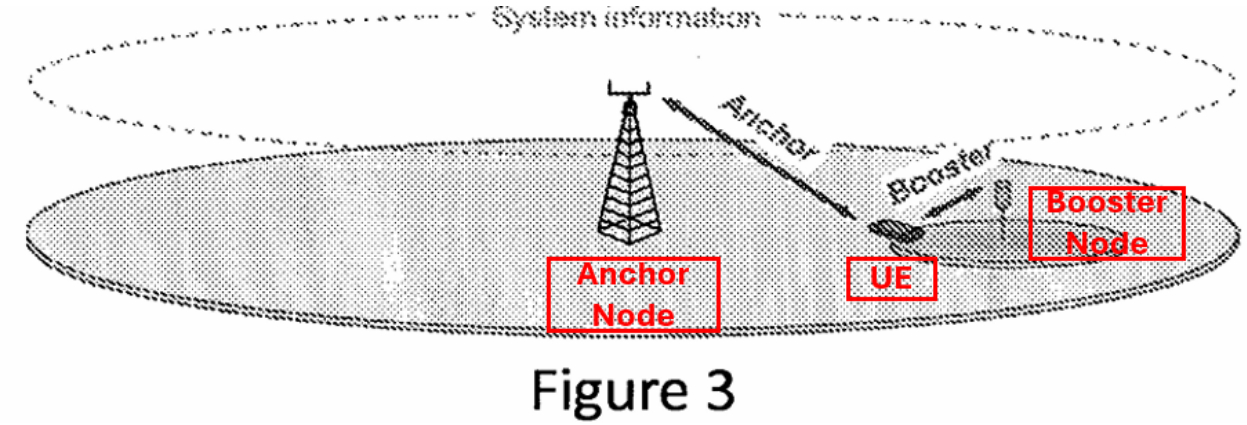


FIG. E – FIG. 3 of EX1005, Dudda-prov (annotated)

VII. Overview of the '283 Patent

A. Subject Matter Overview

56. The '283 Patent is titled "Method and apparatus for wireless link control in wireless communication system supporting dual connectivity." The '283 Patent was issued on September 12, 2017, from U.S. Patent Application No. 14/782,534, and purports to claim priority to April 5, 2013.

57. The '283 Patent purports to address the need for "a radio link control method considering the dual connectivity" when a problem occurs in one radio link, but the other radio link can still be available, and is therefore directed to a method and an apparatus for radio link control in wireless communication systems

supporting dual connectivity. EX1001, 1:18-22, 2:29-35.

58. Notably, the ’283 Patent concedes that “in the related art, the user equipment may monitor one radio link and when a problem occurs in the corresponding link, a radio link failure (RLF) may be declared.” EX1001, 7:22-25. For example, the ’283 Patent further concedes that it is known in the art to “declare the radio link failure and perform a radio resource control (RRC) reestablishment procedure.” EX1001, 7:28-32.

59. In this context, the ’283 Patent claims that there is a need for individually managing radio links under dual connectivity by declaring an RLF on the radio link on which the RLF occurs while still performing data transmission/reception through the other available radio link without performing an RRC reestablishment procedure. EX1001, 3:24-34.

60. FIG. 3 of the ’283 Patent “illustrates one example of a dual connectivity situation of UE applied to an exemplary embodiment.” EX1001, 9:14-15. FIG. 3 depicts a dual connectivity situation in which a UE (annotated in the yellow box) transmits/receives the service from a macro base station (annotated in the green box) through the macro cell (annotated in green), as well as transmits/receives the service from a small base station (annotated in the red box) through the small cell (annotated in red). EX1001, 10:16-22.

FIG. 3

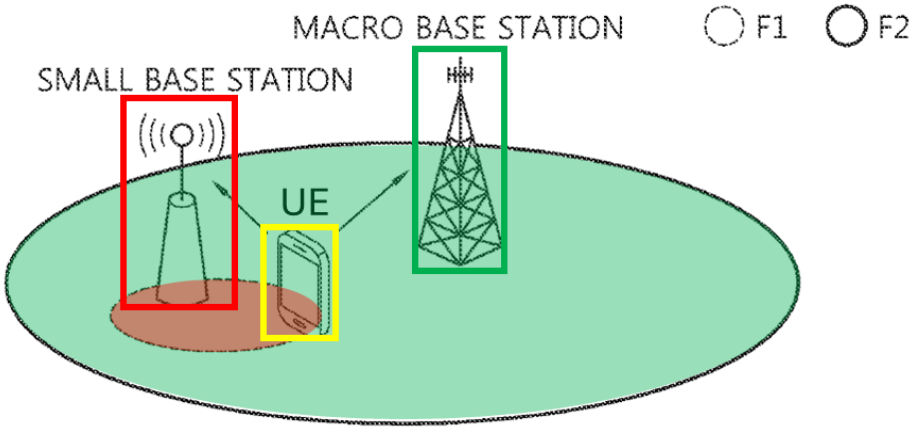


FIG. F – FIG. 3 of EX1001, '283 Patent (annotated)

61. In this situation, the '283 Patent provides that because radio links are constituted between the UE and the two base stations, respectively, to allow the UE to simultaneously use the two cells, "individual controlling the radio link is required." EX1001, 9:22-28.

62. As an example of how to do this, the '283 Patent provides FIG. 4, which "illustrates an example of deconfiguring, when a radio link failure occurs in a small cell, the corresponding small cell according to an exemplary embodiment." EX1001, 10:20-22. In FIG. 4, it shows a UE (annotated in yellow) connected to the macro base station (annotated in green) through the macro cell, wherein that UE is also connected to the small base station (annotated in red) through the small cell. The '283 Patent explains that "the macro cell constituted in the macro base station is the primary serving cell and the small cell constituted in the small base station is the secondary serving cell." EX1001, 10:22-27.

FIG. 4

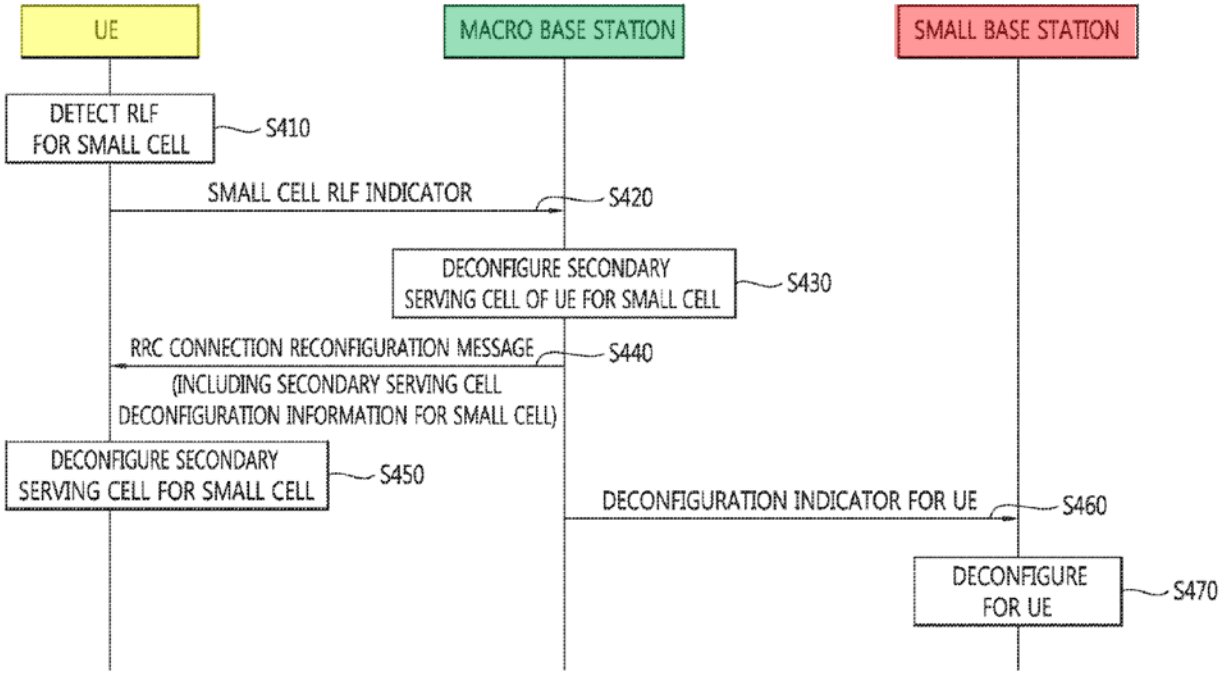


FIG. G – FIG. 4 of EX1001, '283 Patent (annotated)

63. FIG. 4 depicts a situation where the UE detects RLF for the small cell at S410 and, in response, transmits a small cell RLF indicator to the macro base station at S420. EX1001, 10:28-42. In response, the macro base station deconfigures the secondary serving cell of the UE at S430 by reconfiguring RRC-related parameters and transmits an RRC connection reconfiguration message to the UE at S440. EX1001, 11:4-11. Then, the UE deconfigures the secondary serving cell by reconfiguring the RRC-related parameters based on the secondary serving cell deconfiguration information in the RRC connection reconfiguration message at S450. EX1001, 11:12-18. The macro base station also transmits a deconfiguration

indicator for the UE to the small base station to remove its configuration for the UE at S460. EX1001, 11:19-23.

B. Prosecution History of the '283 Patent

64. I have reviewed the prosecution history of the '283 Patent. Upon the issuance of the first non-final Office Action dated May 10, 2017, claims 1-13 were pending in the application and were rejected as anticipated by U.S. Patent Application Publication No. 2012/0281548 in the name of Lin *et al*. ("Lin-548," EX1013). EX1002, 96-98.

65. Arguing that Lin-548 fails to disclose or suggest stopping PUCCH uplink transmission to the SCELL, the PO amended independent claims 1, 6, and 9 to add the limitation that "wherein the RLF indicator comprises an identifier and the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell." EX1002, 82-89.

66. I disagree with the Patent Owner's argument. Lin-548 explicitly discloses the allegedly novel claim limitation. Specifically, Lin-548 discloses that the "UE autonomously stops UL transmission over the RLF SCELL … to avoid uncontrollable UL transmission and to prevent interference to other users. The UE … stops reporting **CQI/PMI/RI** for the SCELL." EX1013, [0039]. Channel Quality Indicator/Precoding Matrix Indicator/Rank Indicator (CQI/PMI/RI) is well-

known uplink control information (*e.g.*, channel-state reports) transmitted on PUCCH. EX1007, [0040] (describing CQI/PMI/RI are uplink control information); EX1009, § 5, p. 40 (describing PUCCH carries CQI reports). Thus, it is clear that Lin-548 discloses stopping PUCCH uplink transmission over the RLF SCELL.

67. This was followed by an interview in which the PO agreed with an Examiner's Amendment that, among other things, added "based on the RLF for the secondary serving cell" after the above-mentioned limitation to overcome indefiniteness in the claims, resulting in a Notice of Allowance. EX1002, 62-77.

C. Interpretation of the '283 Patent Challenged Claims

68. I have been instructed that the Challenged Claims of the '283 Patent are to be given their ordinary and customary meaning as understood by a POSITA at the time of the alleged invention in light of the specification and the prosecution history pertaining to the patent. I have followed these principles in my analysis set forth in this declaration. I reserve the right to supplement my opinions in this declaration to the extent that any parties later propose claim constructions for any claim terms in the '283 Patent.

VIII. Overview of the Cited References

69. General descriptions provided for the following references and combinations thereof are incorporated into each subsection and mapping of the claims that include citations to these references.

A. Dudda (EX1004, EX1005)

70. Dudda "relates to telecommunications and in particular to methods for adapting a mobile network." EX1004, 1:5-8; EX1005, 1:5-7. Like the '283 Patent, Dudda's disclosures are "described within the context of Long Term Evolution (LTE)." EX1004, 1:12-13; EX1005, 1:12-13; EX1001, 4:24-26.

71. Like the '283 Patent, Dudda addresses the issue of evaluating and reacting to radio link failures in dual connectivity because "it is currently unclear how the UE shall evaluate radio link failures and how the system shall react upon these radio link failures or other connectivity issues of some of the maintained connections." EX1004, 3:61-4:7, 7:19-23; EX1005, 4:18-26; 8:23-26.

72. Like FIG. 3 of the '283 Patent, FIG. 3 of Dudda also discloses a UE in dual connectivity. Specifically, Dudda provides that "FIG. 3 illustrates the feature of dual connectivity of a UE 302" and Dudda discloses a "UE 302 in dual connectivity [which] maintains simultaneous connections 334a, 334b to anchor and booster nodes 304a, 304b." EX1004, 4:48-52; EX1005, 5:20-23. Below, I have annotated UE 302 in the yellow box, anchor node 304a in the green box, and booster node 304b in the red box. As shown in FIG. H below, UE 302 is simultaneously connected to a macro cell (annotated in green) provided by anchor node 304a, and a small cell (*e.g.*, a pico-cell, annotated in red) provided by booster node 304b. EX1004, FIG. 3; EX1005, FIG. 3. Anchor node 304a and booster node 304b in FIG.

3 are examples of "first access node/source eNB" and "second access node/assisting eNB," respectively. EX1004, 10:50-56. As can be seen below, the similarities between FIG. 3 of Dudda and FIG. 3 of the '283 Patent are striking.

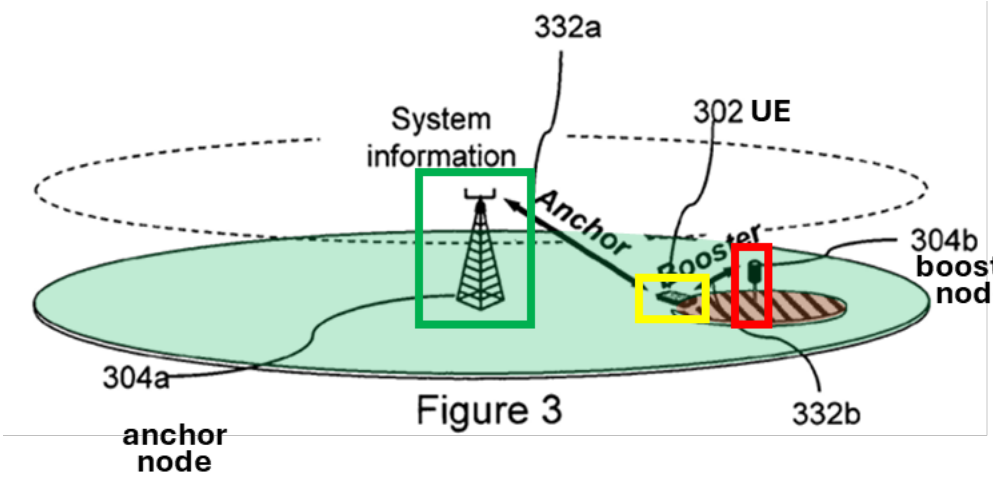


FIG. H – FIG. 3 of EX1004, Dudda (annotated)

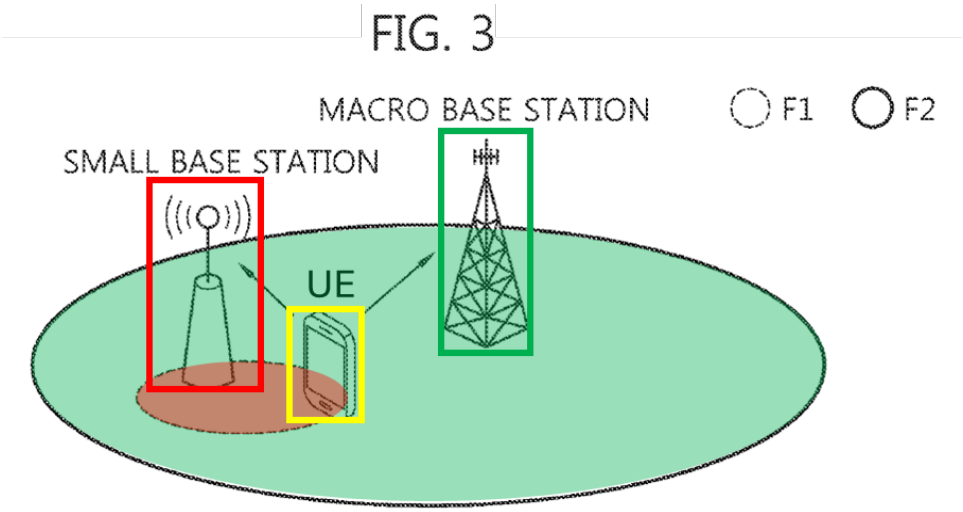


FIG. F – FIG. 3 of EX1001, '283 Patent (annotated)

73. In the context of wireless networks supporting dual connectivity (*e.g.*, FIG. 3), Dudda "provide[s] measures with which a network adaption of a mobile network in a case a degradation of a quality of a connection of [] two connections

between an access node of the mobile network and the terminal may be enabled in an improved way." EX1004, 7:35-39; EX1005, 9:6-8.

74. Specifically, with respect to FIG. 8, a system supporting dual connectivity between UE 802 and source eNodeB 804/assisting eNodeB 808, and reacting upon RLF on the assisting cell, as well as the method thereof are disclosed in detail. EX1004, 17:46-50, 19:9-10; EX1005, 11:25-26, 12:28.

75. First, steps 1-6 of FIG. 8 describe a procedure for establishing RRC connections between UE 802 and source eNodeB 804 and assisting eNodeB 808, respectively: "UE 802 [] is first configured with a measurement configuration (1) issuing an early measurement report (2)," "source eNB 804 [] will go into RRC diversity state where RRC messages are transmitted and received to the UE 802 [] directly and additionally send to/received from the assisting eNB 808 [] for relaying to/from the UE 802," and "UE 802 [] will start a RACH procedure towards the assisting eNB 808 [] to become synchronized to it." EX1004, 17:60-18:30; EX1005, 11:25-12:6.

76. Then, steps 7-11 of FIG. 8 describe how the network reacts to an RLF on the assisting cell: "after the UE 802 has measured a Layer-3 RLF ... towards the assisting cell (FIG. 8), it will stop the transmission on this link and trigger the transmission of the (7) RLF warning message … towards the source eNB 804," "source eNB 804 will send an indication to the assisting eNB 808 to stop the RRC

relaying functionality (8) for the UE 802," and "source eNB 804 uses the RRC reconfiguration procedure (10, 11) to reconfigure the UE 802 to leave RRC diversity mode and be solely connected to the source cell." EX1004, 18:56-19:8; EX1005, 12:8-26.

B. Lin (EX1006)

77. Similar to Dudda and the '283 Patent, Lin relates to wireless communication, particularly "a mechanism of Radio Link failure (RLF) handling in small cell networks." EX1006, [0001]. Lin's wireless communication is also described in the context of LTE. EX1006, [0002]. Indeed, Lin also recognizes that "[i]n the current cell network system, radio link monitoring (RLM) and radio link failure (RLF) detection are only applied on PCELL, not on SCELLs." EX1006, [0019].

78. Like FIG. 3 of the '283 Patent, FIG. 2 of Lin also discloses a UE in dual connectivity which is connected to both an anchor eNB 201 and a drift eNB 202. Specifically, FIG. 2 of Lin "is a diagram that illustrates a procedure establishing a RRC connection to a radio access network in a wireless communication system 200 in accordance with one novel aspect." EX1006, [0021]. UE 203 is simultaneously connected to a primary serving cell (PCELL, annotated in green) provided by anchor eNB 201, and a secondary serving cell (SCELL, annotated in red) provided by drift eNB 202. EX1006, [0021]-[0022], FIG. 2. Below, I have also annotated UE 203 in

the yellow box, anchor eNB 201 in the green box, and drift eNB 202 in the red box.

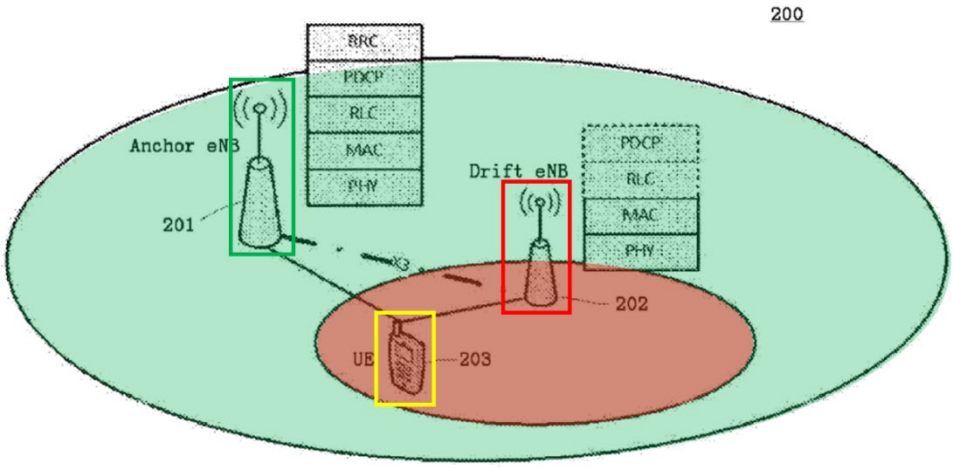


Fig. 2

FIG. I – FIG. 2 of EX1006, Lin (annotated)

79. Lin further discloses that its UE may be equipped with multiple PHY modules/entities and thus, is capable of supporting small cell operation. EX1006, [0029]-[0030], FIG. 3.

80. Lin breaks up its disclosures relating to radio link monitoring (RLM) and radio link failure (RLF) into various sub-sections, such as "UE RLM on multiple cells: Configurable RLM/RLF," "Report of RLF message," "RLF content," and "Reaction to the RLF." EX1006, [0031]-[0032], [0051], [0057], [0063]. Notably, Lin discloses preventing spontaneous UL transmissions (PUCCH, SRS, SPS), disabling/releasing corresponding MAC entity, and deactivating the RLF serving cell upon RLF detection on the SCELL. EX1006, Claim 9, [0063]-[0071]. It is clear

that those sub-sections relate to the same embodiment of RLM/RLF applicable to wireless communication system 200 in FIG. 2.

C. Pelletier (EX1007)

81. Similar to Dudda, Lin, and the '283 Patent, Pelletier is related to wireless communication, in particular, for addressing UE (referred to in Pelletier as a wireless transmit/receive unit or WTRU) behavior in response to configuration, configuration parameters, and access issues related to the activation/deactivation process when the UE is configured with multiple serving cells (*e.g.*, supporting dual connectivity). EX1007, [0002], [0004], [0010]. Pelletier's wireless communication is described in the context of LTE as well. EX1007, [0003].

82. FIG. 1A of Pelletier discloses a wireless network supporting dual connectivity. Specifically, FIG. 1A discloses a communication system 100 including base stations 114a and 114b (*e.g.*, eNodeB), each transmitting and receiving wireless signals in a cell, and WTRUs 102a-102d (*e.g.*, UE), each wirelessly communicating with base stations 114a and/or 114b. EX1007, [0010]-[0013]. WTRU 102c, which is annotated in the yellow box, is configured with dual connectivity as it communicates with both base station 114a (annotated in the green box), which employs a cellular-based radio technology in a radio access network (RAN) 104 connected to core network 106, as well as with base station 114b (annotated in the red box), which employs an IEEE 802 radio technology in a

picocell or femtocell. EX1007, [0012], [0018]-[0019], [0021]. Pelletier explains that WTRUs 102a, 102b, 102c, 102d may be a user equipment (UE), and base stations 114a, 114b may be an eNodeB. EX1007, [0010]-[0011].

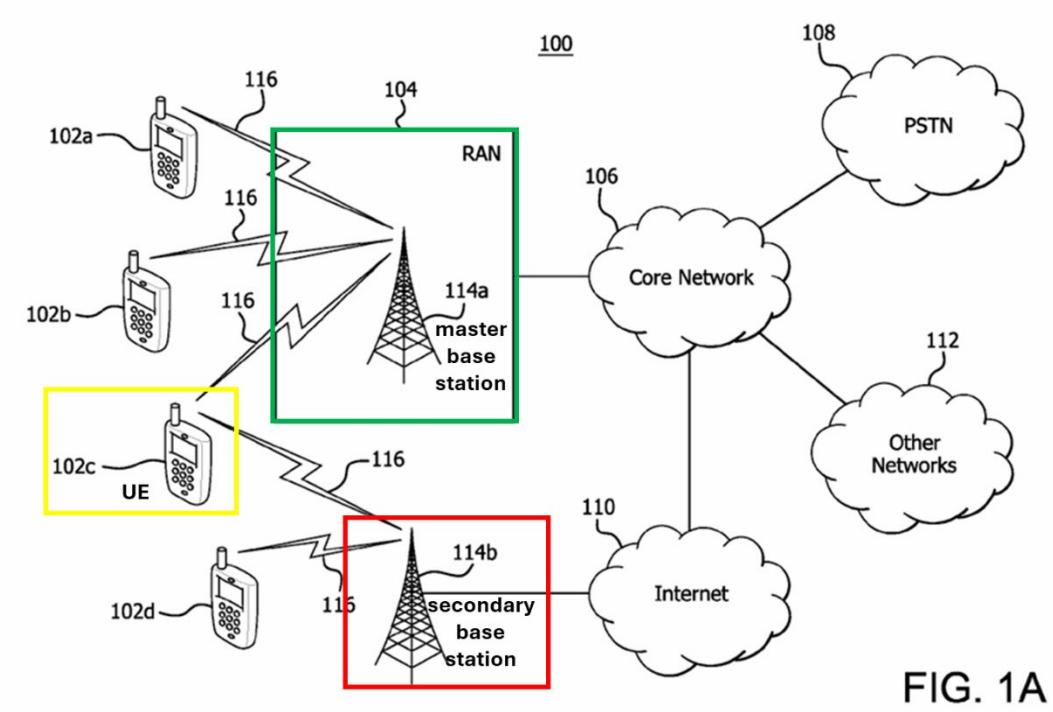


FIG. J – FIG. 1A of EX1007, Pelletier (annotated)

83. A POSITA would have understood that Pelletier's base station 114a and base station 114b are a "*master base station*" and a "*secondary base station*" in dual connectivity with WTRU 102c ("*user equipment*") through a "*primary serving cell*" and a "*secondary serving cell*," respectively. This is because Pelletier discloses that the phrase "serving cell" includes "primary cell (PCell)," which includes "the cell … in which the WTRU either performs the initial connection establishment procedure or initiates the connection re-establishment procedure, or the cell

indicated as the primary cell in the handover procedure," and that "secondary cell (SCell)," which includes "the cell … which may be configured once an RRC connection is established and which may be used to provide additional radio resources." EX1007, [0042]-[0043], [0045], [0160]. Pelletier's base station 114a is a "*master base station*" also because it is in RAN 104 and in communication with core network 106, different from base station 114b. EX1007, [0012], [0018]-[0019].

84. Like Dudda, Lin, and the '283 Patent, Pelletier discloses error handling in communication system 100 supporting dual connectivity, including RLF detected in an SCell. EX1007, [0102] (describing "example methods that follow an error condition"). Specifically, Pelletier discloses that "WTRU may also deactivate a concerned SCell if the WTRU may detect RLF in a specific CC under certain situations … if the specific SCell is a SCell of the WTRUs configuration, the WTRU may deactivate the specific SCell after it determines downlink and/or uplink RLF for said specific SCell." EX1007, [0102]. A POSITA would have understood that a CC in Pelletier corresponds to a cell, *e.g.*, SCell. EX1007, [0041]-[0042], [0044].

85. In response to detecting uplink RLF for SCell, Pelletier describes deactivating the SCell on which the RLF occurs and removing the configuration of the SCell from the WTRU's configuration. EX1007, [0120] ("[w]hen the WTRU deactivates a concerned SCell, the WTRU may stop any UL transmissions (UL-SCH, PUSCH, SRS) for the deactivated SCell UL after a time t.").

86. Pelletier is clear that such deactivation stops uplink transmission of PUSCH, PUCCH, and SRS to the secondary serving cell. For example, Pelletier discloses the following:

> "The principles of activation and deactivation of a CC from the WTRU perspective herein may apply to at least one of a plurality of functions related to the CC. For example, for a DL CC, it may relate to PDCCH monitoring/decoding of a subset or all DCI formats such as UL DCIs, DL DCIs, both, or subsets thereof or PDSCH buffering/decoding. **For a UL CC, it may relate for example to a PUSCH transmission, to a PUCCH transmission, to the transmission of CQI/PMI/RI or SRS transmission**." EX1007, [0047].

> "Described herein are scenarios and methods related to transmissions by the WTRU on configured downlink and/or **uplink resources affected by** activation and **deactivation of SCells**. Such resources are configured for a WTRU by dedicated signaling and may include **periodic dedicated sounding reference signal (SRS) transmission resource**s, UL and/or DL SPS resources, **periodic transmission of CQI, PMI, RI either on a dedicated PUCCH resource allocation or on a PUSCH transmission**, a dedicated resource for **SR transmission on PUCCH**, a configuration for transmission of **HARQ ACK/NACK feedback on one or more PUCCH resources**, and the like." EX1007, [0104].

That is, the deactivation of the SCell upon RLF affects the uplink resources of the WTRU, including PUSCH, PUCCH, and SRS.

87. Pelletier also explicitly discloses that a WTRU configured with at least one SCell stops "transmit[ting] SRS for the concerned SCell," "report[ing] CQI, PMI, or RI for the concerned SCell," and "transmit[ting] on PUSCH for the SPS

resources" when the concerned SCell is deactivated. EX1007, [0085]-[0087]. CQI, PMI, and RI are uplink control information transmitted on PUCCH. EX1007, [0040].

IX. Grounds 1 and 2: Dudda Anticipates or Otherwise Renders Obvious Claims 1-13

A. Independent Claim 1

88. Claim 1 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

> **[1.P]** A user equipment for performing radio link control in a wireless communication system supporting dual connectivity, the user equipment comprising:
> **[1.a]** a processor configured to detect a radio link failure (RLF) for a secondary serving cell provided by a secondary base station (secondary eNB, SeNB) and to generate an RLF indicator indicating occurrence of the RLF for the secondary serving cell; and
> **[1.b]** a transmitting unit configured to transmit the RLF indicator to a master base station (master eNB, MeNB) connected through radio resource control (RRC),
> **[1.c]** wherein the RLF indicator comprises a cell identifier (cell ID), and
> **[1.d]** the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

[1.P] A user equipment for performing radio link control in a wireless communication system supporting dual connectivity, the user equipment comprising:

89. Dudda discloses a UE (corresponding to the claimed "*user equipment*") having radio link control (RLC) capability (corresponding to the claimed "*performing radio link control*") in a system capable of dual connectivity (corresponding to the claimed "*wireless communication system supporting dual connectivity*").

90. As shown in FIG. H below, Dudda provides that "FIG. 3 illustrates the feature of dual connectivity of a UE 302" and Dudda discloses a "UE 302 [(annotated in the yellow box)] in dual connectivity [which] maintains simultaneous connections 334*a*, 334*b* to anchor and booster nodes 304*a*, 304*b* [(annotated in green and red boxes, respectively)]." EX1004, 4:48-65; EX1005, 5:22-27. Thus, the system of FIG. 3 is the claimed "*wireless communication system supporting dual connectivity.*"

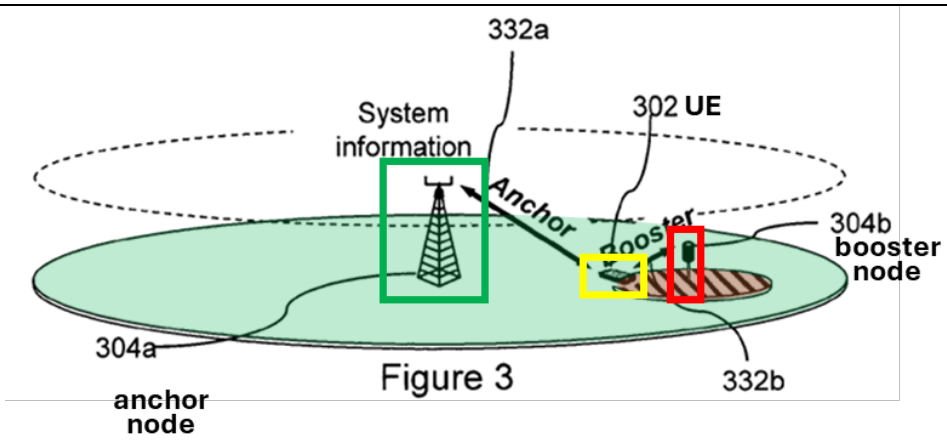


FIG. H – FIG. 3 of EX1004, Dudda (annotated)

91. FIG. 8 of Dudda depicts an embodiment of Dudda "illustrating a method for adapting a mobile network." EX1004, 9:36-37; EX1005, 10:9-10. It is clear that FIG. 8 of Dudda discloses an embodiment that is in the same dual connectivity configuration as that in FIG. 3. EX1004, 10:50-56; *see* Section VIII.A. For example, Dudda provides that "a mobile network 800 comprises a[] user equipment 802, a source eNodeB 804, and an assisting eNodeB 808" and that "the system is capable of dual connectivity for the UE 802." EX1004, 17:48-50, 19:9-14; EX1005, 12:28-31. Thus, the system in FIG. 8 is also the claimed "*wireless communication system supporting dual connectivity*."

92. The UEs disclosed in Dudda, such as UE 302 and UE 802, have radio link control (RLC) capability. Specifically, Dudda describes its protocol architecture as including radio link control (RLC) layer in order to realize dual connectivity. EX1004, 5:7-19; EX1005; 6:4-8. It is well known in the art that the RLC layer is responsible for segmentation/concatenation, retransmission handling,

duplicate detection, and in-sequence delivery to higher layers. *See* Section VI.C. Thus, a POSITA would have understood that the UE (*e.g.*, 302, 802) of Dudda is capable of performing radio link control (RLC).

[1.a] a processor configured to detect a radio link failure (RLF) for a secondary serving cell provided by a secondary base station (secondary eNB, SeNB) and to generate an RLF indicator indicating occurrence of the RLF for the secondary serving cell; and

93. Dudda's UE 802 includes a processor 1005 shown in FIG. 10, which is the claimed "*processor.*"

94. A POSITA would have understood that the disclosures of FIG. 10 of Dudda apply to the UE 802 described in FIG. 8. FIG. 10 of Dudda depicts "a terminal 1002 for adapting a mobile network," which "may correspond to the terminal 802 or 902." EX1004, 25:36-38; EX1005, 22:22-23:4. Dudda makes clear that the "[t]he terminal 1002 is adapted to perform a method according to embodiments described above and comprises respective functionality based units [e]mbedded in respective physical units 1003, 1005, 1007 illustrated in FIG. 10." EX1004, 26:8-11; EX1005, 23:1-4. The "embodiments described above" certainly include the system and method of adapting a mobile network shown in FIG. 8.

95. As shown in FIG. K below, FIG. 10 of Dudda depicts processor 1005 (annotated in red). Accordingly, Dudda's UE 802 includes processor 1005.

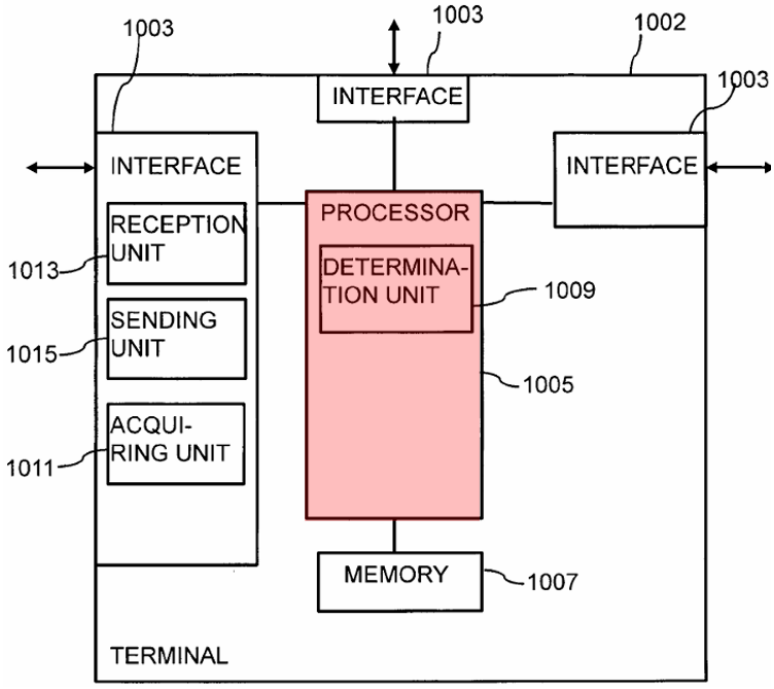


FIG. K – FIG. 10 of EX1004, Dudda (annotated)

96. Dudda discloses that processor 1005 of UE 802 is configured to detect an RLF for an assisting cell (corresponding to the claimed "*secondary serving cell*") provided by an assisting eNodeB 808 (corresponding to the claimed "*secondary base station (secondary eNB, SeNB)*"). Specifically, Dudda discloses that "a RLF between the UE 802 and the assisting eNodeB 808 occurs in a step 8[9]4" and "UE 802 has measured a Layer-3 RLF … towards the assisting cell (FIG. 8)." EX1004, 18:31-32, 18:35-37, 18:56-60; EX1005, 12:8, 13-16. Below, I have annotated UE 802 in yellow, assisting eNodeB 808 in red, and the occurrence of the RLF (step 894) in the green box.

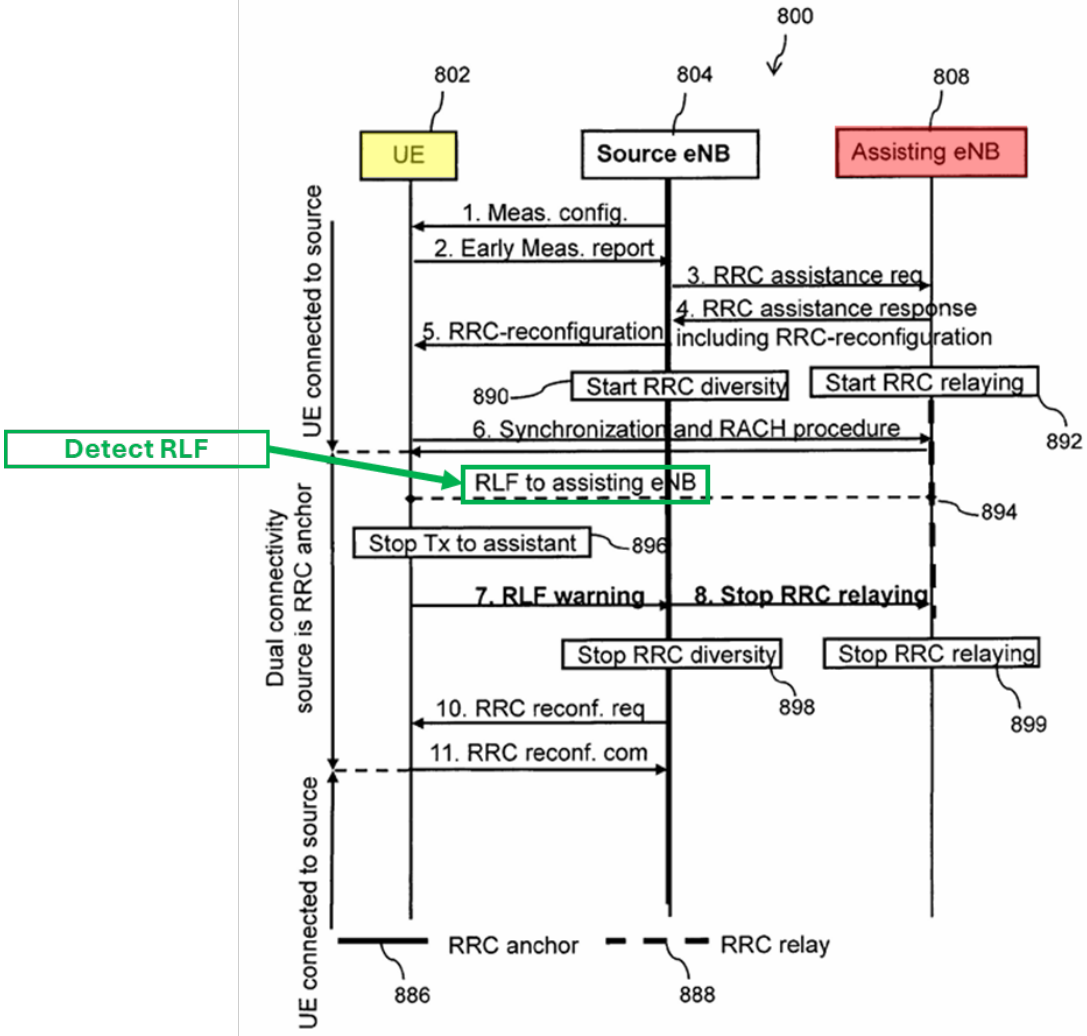


FIG. L – FIG. 8 of EX1004, Dudda (annotated)

97. According to Dudda's disclosures, a POSITA would have understood that assisting eNodeB 808 (*e.g.*, an example of the second access node) plays an assistant role in dual connectivity with UE 802. Dudda discloses that "[i]n such a communication scenario, the first access node may control the data transmission for the terminal and the **second access node may assist in the data transmission** for the terminal." EX1004, 10:1-4, 10:50-56; EX1005, 25:5-7, 26:16-19. For example, Dudda provides that "[i]n addition to the anchor 304*a*, the UE 302 may be connected

to one or several booster nodes 304*b* for added user plane support." EX1004, 4:57-62; EX1005, 5:25-27. Accordingly, a POSITA would have understood that assisting eNodeB 808 is the claimed "*secondary base station,*" and the assisting cell provided by assisting eNodeB 808 is the claimed "*secondary serving cell*" provided by "*secondary base station.*"

98. Dudda further discloses that UE 802's processor 1005 is configured to generate an RLF-warning message (corresponding to the claimed "*an RLF indicator indicating occurrence of the RLF*") for the assisting cell. Dudda discloses that "**after the UE 802 has measured a Layer-3 RLF** (*i.e.* timer T310 expired) towards the assisting cell (FIG. 8), **it will** stop the transmission on this link and **trigger the transmission of the (7) RLF warning message**, as further described below, towards the source eNB 804." EX1004, 18:56-60; EX1005, 12:13-16. It is clear that Dudda generates the RLF-warning message first in order to transmit it to source eNB 804. For example, Dudda provides pseudo-code examples of generating the RLF-warning by "stor[ing] the following radio link failure information in the modified VarRLF-Report according to the selection of links to transmit the RLF warning." EX1004, 21:24-62; EX1005, 15:29-16:23.

[1.b] a transmitting unit configured to transmit the RLF indicator to a master base station (master eNB, MeNB) connected through radio resource control (RRC),

99. Dudda discloses that its UE 802 also includes a sending unit 1015

(corresponding to the claimed "*transmitting unit*"). With respect to FIG. 10, Dudda discloses that "[t]he one or more interfaces 1003 may further comprise a reception unit 1013 and **a sending unit 1015 for implementing** receiving and **sending capabilities of the one or more interfaces 1003, respectively**." EX1004, 26:2-5; EX1005, 22:22-32, FIG. 10. I have annotated sending unit 1015 in purple below in FIG. M. As I explained above in Section IX.A([1.a]), Dudda's disclosures with respect to FIG. 10 apply to UE 802 described in FIG. 8.

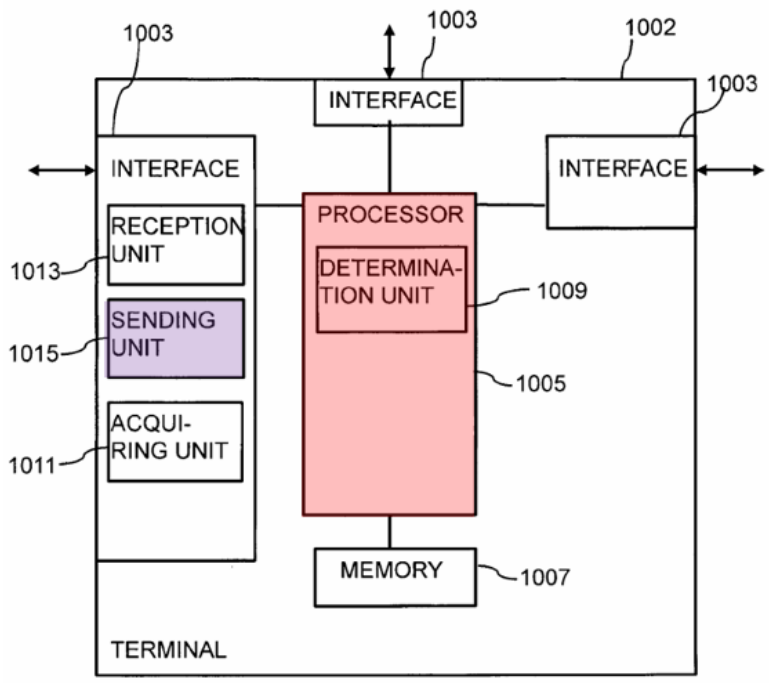


FIG. M – FIG. 10 of EX1004, Dudda (annotated)

100. Dudda discloses that UE 802's sending unit 1015 is configured to transmit the RLF-warning message (corresponding to the claimed "*RLF indicator*") to source eNB 804 (corresponding to the claimed "*master base station (master eNB, MeNB)*"). Dudda discloses that UE 802 "sends a RLF warning to the source eNodeB

804" and "trigger[s] the transmission of the (7) RLF warning message … towards the source eNB 804". EX1004, 18:38-39, 18:56-60; EX1005, 12:13-16. In FIG. N below, I have annotated UE 802 in yellow, the transmission of the RLF-warning message (*i.e.*, step 7) in the purple box, and source eNB 804 in green.

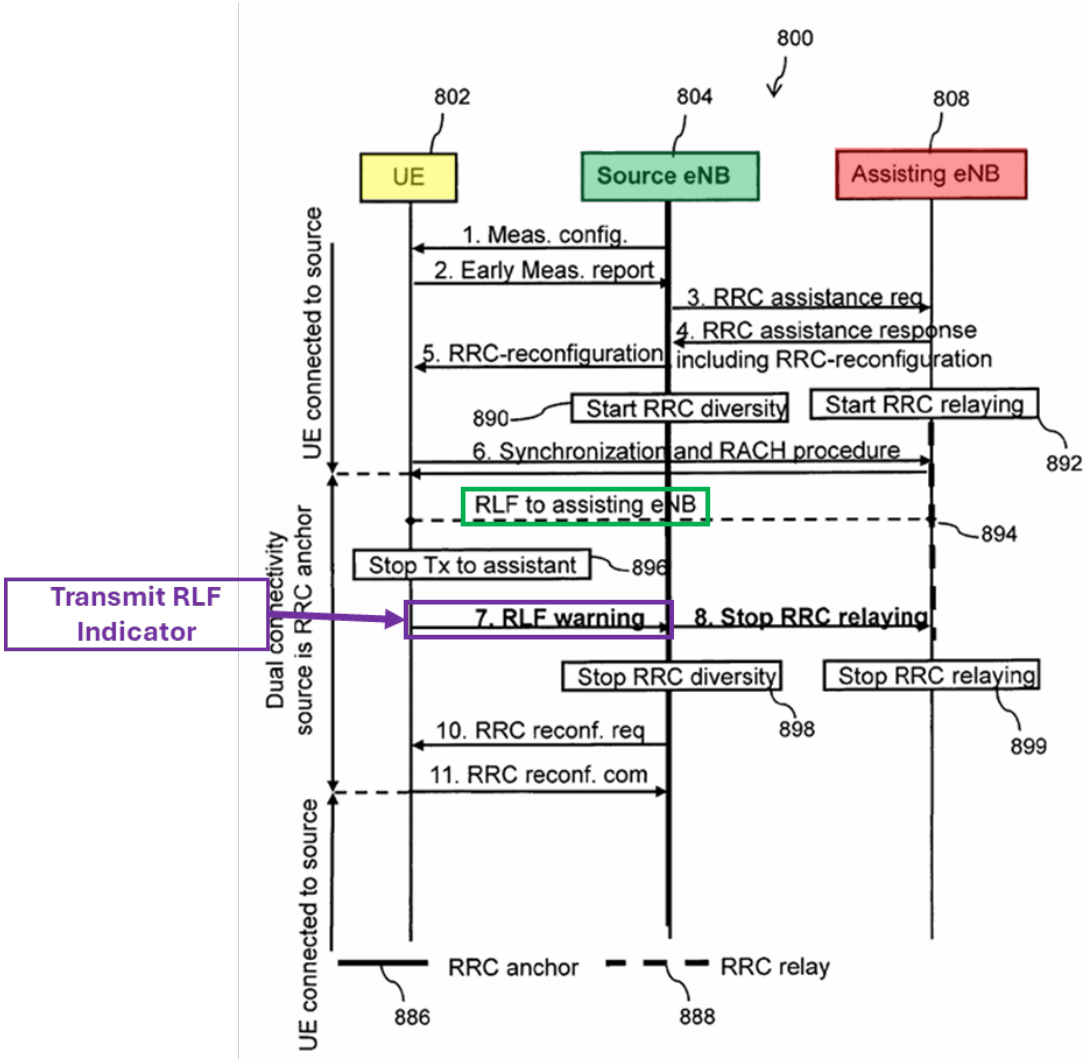


FIG. N – FIG. 8 of EX1004, Dudda (annotated)

101. According to Dudda's disclosures, a POSITA would have understood that source eNodeB 804 (*e.g.*, an example of the first access node) plays a control role in dual connectivity with UE 802. Dudda discloses that "[i]n such a

communication scenario, the **first access node may control the data transmission** for the terminal and the second access node may assist in the data transmission for the terminal." EX1004, 10:1-4, 10:50-56; EX1005, 25:5-7, 26:16-19. For example, Dudda provides that "the anchor node 304*a* terminates the control plane connection towards the UE 302 and is thus the controlling node of the UE 302." EX1004, 4:52-57; EX1005, 5:23-24. Accordingly, a POSITA would have understood that source eNodeB 804 is the claimed "*master base station*."

102. Dudda specifies that its UE 802 is connected to source eNodeB 804 through radio resource control (RRC). For example, with respect to FIG. 8, Dudda describes "the signaling involved in the setup of the RRC connection." EX1004, 17:46-48; EX1005, 11:25-26. This set up occurs before the detection of RLF failure, and Dudda describes how UE 802 and source NodeB 804 enter into an RRC diversity state such that "RRC messages are transmitted and received to the UE 802 [] directly." EX1004, 18:24-28; EX1005, 12:2-6. As shown in FIG. O below, the RLF detection (step 894) is annotated in the green box, and the RRC diversity start (step 890) is annotated in the blue box.

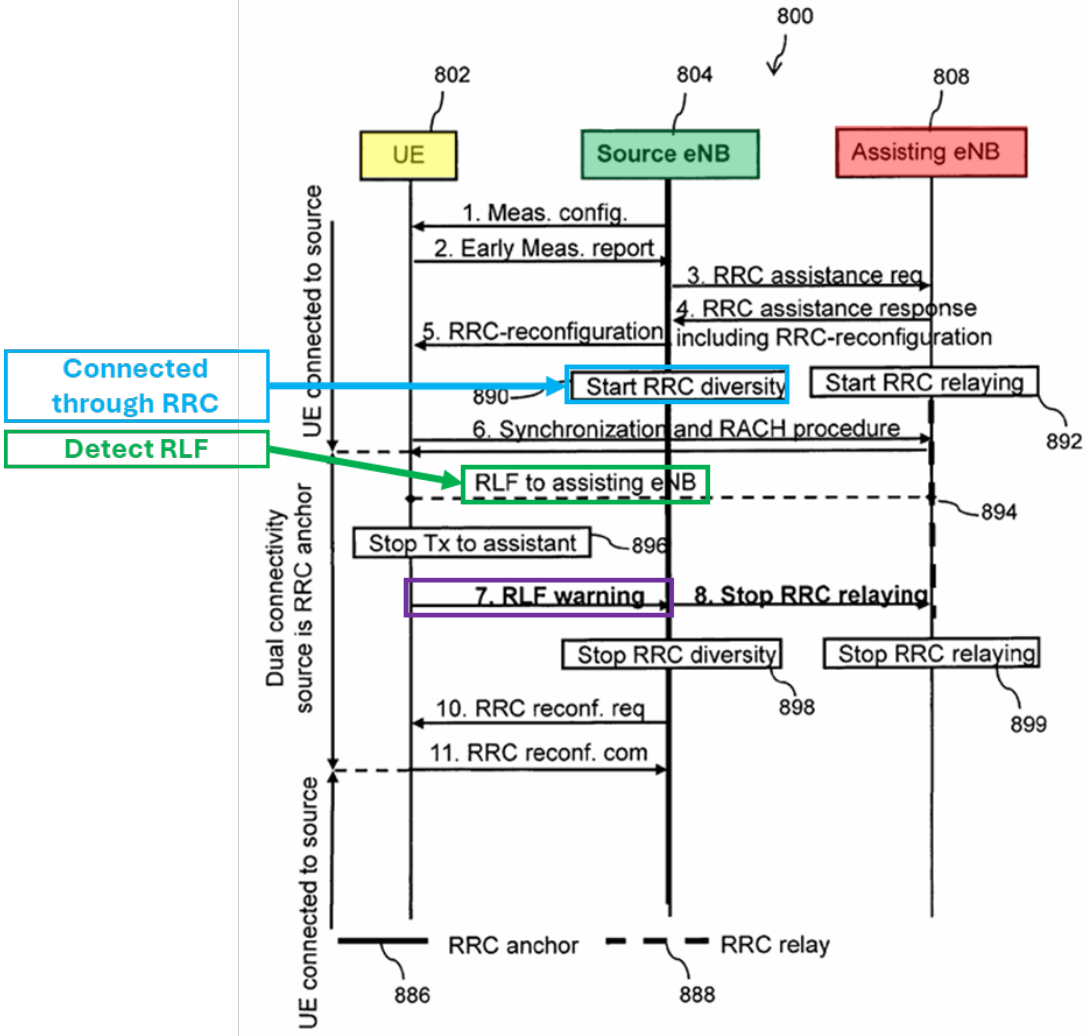


FIG. O – FIG. 8 of EX1004, Dudda (annotated)

103. Dudda further discloses that the RLF-warning message is transmitted as an "**RRC** RLF warning message." EX1004, 16:22-25, 16:64; EX1005, 11:3. That is, Dudda also specifies that the RLF-warning message is transmitted via the RRC connection in the form of an RRC message.

[1.c] wherein the RLF indicator comprises a cell identifier (cell ID), and

104. Dudda discloses that the RLF-warning message (corresponding to the

claimed "*RLF indicator*") includes a cell identification indicator (corresponding to the claimed "*cell identifier (cell ID)*"). For example, Dudda discloses that "RLF-warning message … may further include an indicator to which connection the [RLF]-warning belongs," including "cell global ID, physical cell ID, carrier frequency of this cell." EX1004, 23:1-12; EX1005, 18:8-17. Dudda also discloses, including in the RLF-warning message, quality degradation information, which includes "a cell identification indication indicative of an identification of an area, particularly a cell, being served by the access node associated with the failed connection." EX1004, 29:60-30:23; EX1005, 28:20-29:15.

[1.d] the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

105. Dudda discloses that the UE stops uplink transmission to the assisting cell (corresponding to the claimed "*secondary serving cell*") based on the RLF for the assisting cell. Specifically, Dudda discloses that "[a]s illustrated in FIG. 8, a RLF between UE 802 and the assisting eNodeB 808 occurs in a step 884. **In a step 896, the UE 802 stops transmitting to the assisting eNodeB 808**." EX1004, 18:35-38, 18:56-60 ("**after the UE 802 has measured a Layer-3 RLF** (*i.e.* timer T310 expired) towards the assisting cell (FIG. 8), **it will stop the transmission on this link**"); EX1005, 12:13-16. The consequence of this is that UE 802 will "be solely

connected to the source cell." EX1004, 19:6-9; EX1005, 12:24-26. In FIG. P below, I have annotated the RLF detection (step 894) in the green box and stopping uplink transmissions to assisting eNodeB 808 (step 896) in the red box.

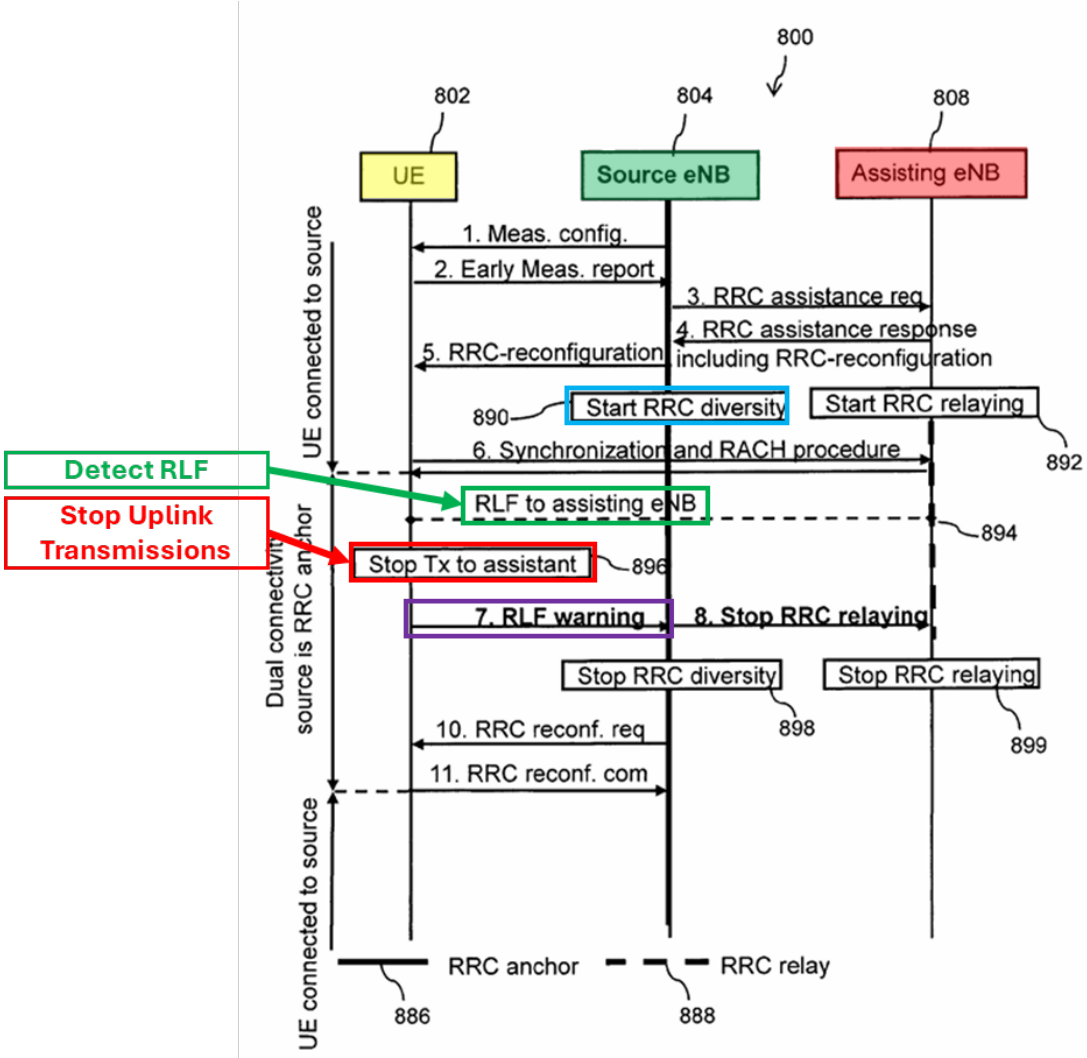


FIG. P – FIG. 8 of EX1004, Dudda (annotated)

106. Indeed, Dudda explains throughout that once the UE detects an RLF on the second connection/link with the second access node/assisting eNodeB, this will result in "stop[ping] communicating … in an uplink direction," "stop[ping] transmission … on the link for which RLF is detected," "disconnecting the second

connection," "stopping to employ the second access node for the data transmission for the terminal," "stopping to send the duplicated data to the second access node," etc. EX1004, 11:53-66, 21:31-59, 29:39-59; EX1005, 16:21, 28:1-18. Accordingly, Dudda explicitly teaches that the UE stops uplink data transmission to the assisting cell based on the RLF for the assisting cell.

107. Among the uplink data transmissions that Dudda's UE stops transmitting to the assisting cell based on RLF for the assisting cell, Dudda teaches or at least suggests stopping "*physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS)*."

108. First, it is clear that stopping uplink transmission to the assisting eNodeB, as taught by Dudda, includes preventing the UE from making **any** uplink transmission to the assisting cell, including the claimed "*physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS)*." *See*, *e.g.*, EX1007, [0104] (describing uplink resources affected by deactivation of SCells including SRS, PUCCH, and PUSCH transmission resources). It is well known in the art that stopping such transmissions would avoid uncontrollable uplink transmission and prevent interference to other users. *See*, *e.g.*, EX1013, [0039] (discussing how deactivating a secondary cell in the case of an RLF "avoid[s] uncontrollable UL transmission" and "prevent[s] interference to other users").

109. Second, a POSITA would have found it obvious that stopping uplink transmission to the assisting eNB, as taught by Dudda, also includes stopping existing uplink transmission of the claimed "*physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS)*" in view of common knowledge in the art and the disclosures of Dudda.

110. A POSITA would understand, or at least find it obvious, that in Dudda, PUSCH and PUCCH are used for data transmission from UE 802 to assisting eNodeB 808 such that stopping uplink data transmission would have stopped uplink transmission of PUSCH and PUCCH. Dudda explains that "the term 'data transmission' may comprise transmission of **signaling data and/or payload data in the uplink direction** from the terminal to the mobile network." EX1004, 9:54-58, 28:35-51; EX1005, 25:28-26:10. It is well known in the art that the "signaling data" refers to the control data/information, which is transmitted on PUCCH and PUSCH channels, and the "payload data" refers to user data, which is transmitted on the PUSCH channel. *See*, *e.g.*, EX1007, [0040] ("On the PUSCH, the WTRU may transmit user and/or control data. On the PUCCH, and in some cases on the PUSCH, the WTRU may transmit uplink control information"); EX1009, § 5, p. 40; EX1011, § 8.2.3, pp. 123-124. Uplink control data/information for PUCCH SCell also includes SRS. EX1012, 9:11-13 ("**Uplink control information such as** HARQ feedback, Channel Status Information (CS), **Sounding Reference Signal (SRS)**,

and Scheduling Request (SR) may be transmitted").

111. Also, it is known in the art that uplink resources configured for a UE to an SCell by signaling include SRS, PUCCH, and PUSCH, which are affected by activation and deactivation of the SCell. For example, Pelletier discloses the following:

> Described herein are scenarios and methods related to transmissions by the WTRU on configured downlink and/or **uplink resources affected by activation and deactivation of SCells**. **Such resources are configured for a WTRU by dedicated signaling and may include periodic dedicated sounding reference signal (SRS) transmission** resources, UL and/or DL SPS resources, periodic transmission of CQI, PMI, RI either on a **dedicated PUCCH resource allocation or on a PUSCH transmission**, a dedicated resource for SR transmission **on PUCCH**, a configuration for transmission of HARQ ACK/NACK feedback **on one or more PUCCH resources**, and the like. EX1007, [0104].

112. Accordingly, a POSITA would have understood, or at least find it obvious, that in Dudda, each of PUSCH, PUCCH, and SRS are used for uplink data transmission from the UE (*e.g.*, 802) to the assisting eNB (*e.g.*, 808), so that stopping uplink transmission would have stopped uplink transmission of PUSCH, PUCCH, and SRS.

113. Finally, for SRS, Dudda further discloses, or at the very least suggests, stopping uplink SRS transmission to the assisting cell. It is well known in the art that SRS plays a crucial role in uplink data transmission by supporting various

physical layer functions. One key example is its use in estimating the uplink channel state at different frequencies, as described in EX1011: "SRS [is] transmitted on the uplink to allow for the base station to estimate the uplink channel state at different frequencies." EX1011, § 11.2.2, p. 217. These channel state estimates are then utilized by the network scheduler to dynamically allocate resource blocks with favorable channel conditions for PUSCH transmissions. Additionally, the estimates assist in selecting key transmission parameters, such as the instantaneous data rate and multi-antenna transmission settings, optimizing uplink performance.

114. Furthermore, SRS transmission is essential for effective precoding matrix selection in multi-antenna PUSCH transmissions, a well-established and commonly used technique in LTE systems, to which Dudda pertains. EX1004, 1:12-13, 16:47-49; EX1005, 1:12-13; EX1008, § 8.2, pp. 94-95. Given the critical role of SRS in uplink transmission, stopping its transmission would be a logical step in scenarios where uplink transmission to the assisting eNodeB is to be prevented.

115. Another significant function of SRS transmission is its role in uplink timing estimation. It is well established that SRS assists in maintaining uplink timing alignment by enabling the network to control the UE's uplink transmit timing through the uplink-timing-alignment procedure. EX1011, § 11.2, pp. 210, 217. By stopping SRS transmission, the UE would effectively cease its contribution to timing estimation, further reinforcing the disconnection from the assisting cell.

116. Accordingly, a POSITA would have understood, or at least found it obvious, that transmitting SRS from UE 802 to assisting eNodeB 808 serves essential uplink data transmission functions, including channel state estimation, resource scheduling, and timing alignment, which facilitate PUSCH transmission. Consequently, a POSITA would have also recognized—or at least found it obvious—that stopping such uplink SRS transmission in the event of an RLF would be necessary to avoid unintended uplink activity. EX1007, [0116]-[0120] (discussing various scenarios where "it may be desirable to have methods to avoid transmission of SRS while the WTRU is not active in UL transmissions on PUSCH"). Accordingly, halting SRS transmissions allows the network to effectively manage uplink resources and mitigate potential interference, ensuring stable and efficient operation.

117. Therefore, Dudda alone discloses or at least suggests that "*the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell*."

B. Dependent Claim 2

118. Claim 2 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

[2.P] The user equipment of claim 1, further comprising:

[2.a] a receiving unit configured to receive an RRC connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell from the master base station,

[2.b] wherein the processor is configured to deconfigure the secondary serving cell at the user equipment side based on the secondary serving cell deconfiguration information.

[2.P] The user equipment of claim 1, further comprising:

119. Dudda discloses the apparatus of claim 1. I incorporate my discussion for claim 1.

[2.a] a receiving unit configured to receive an RRC connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell from the master base station,

120. Dudda also discloses that its UE 802 includes a reception unit 1013 (corresponding to the claimed "*receiving unit*"). With respect to FIG. 10, Dudda discloses that "[t]he one or more interfaces 1003 may further comprise **a reception unit 1013** and a sending unit 1015 **for implementing receiving** and sending **capabilities of the one or more interfaces 1003, respectively**." EX1004, 26:2-5; EX1005, 22:22-32. I have annotated reception unit 1013 in green in FIG. Q below. As I explained above in Section IX.A([1.a]), Dudda's disclosures with respect to FIG. 10 apply to the UE 802 described in FIG. 8.

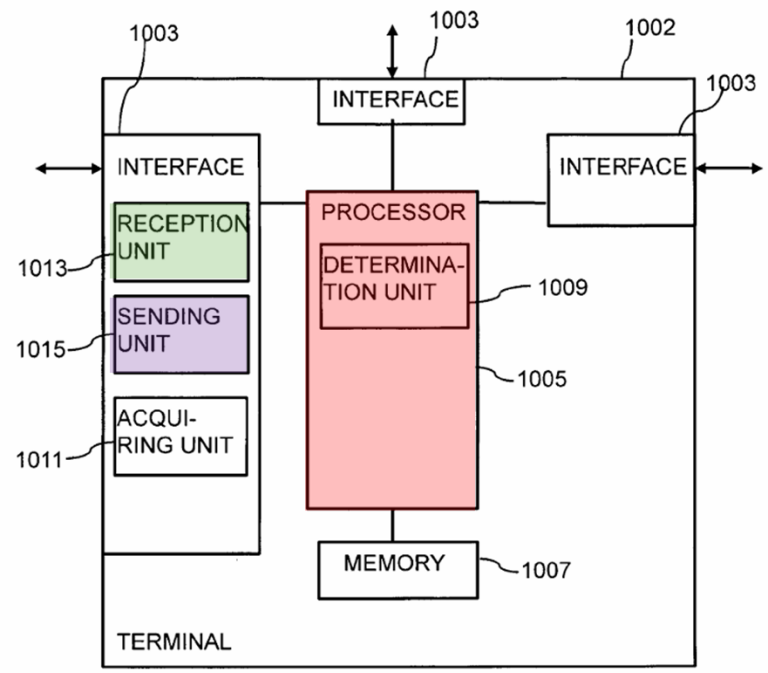


Figure 10

FIG. Q – FIG. 10 of EX1004, Dudda (annotated)

121. Dudda discloses that reception unit 1013 of UE 802 is configured to receive an RRC reconfiguration request from source eNodeB 804 (corresponding to the claimed "*master base station"*). Specifically, Dudda discloses that "source eNodeB 804 sends a RRC reconfiguration request to the UE 802". EX1004, 18:43-46, 19:6-8; EX1005, 12:24-26, FIG. 8. I have annotated this process (*i.e.*, step 10) below in the pink box in FIG. R.

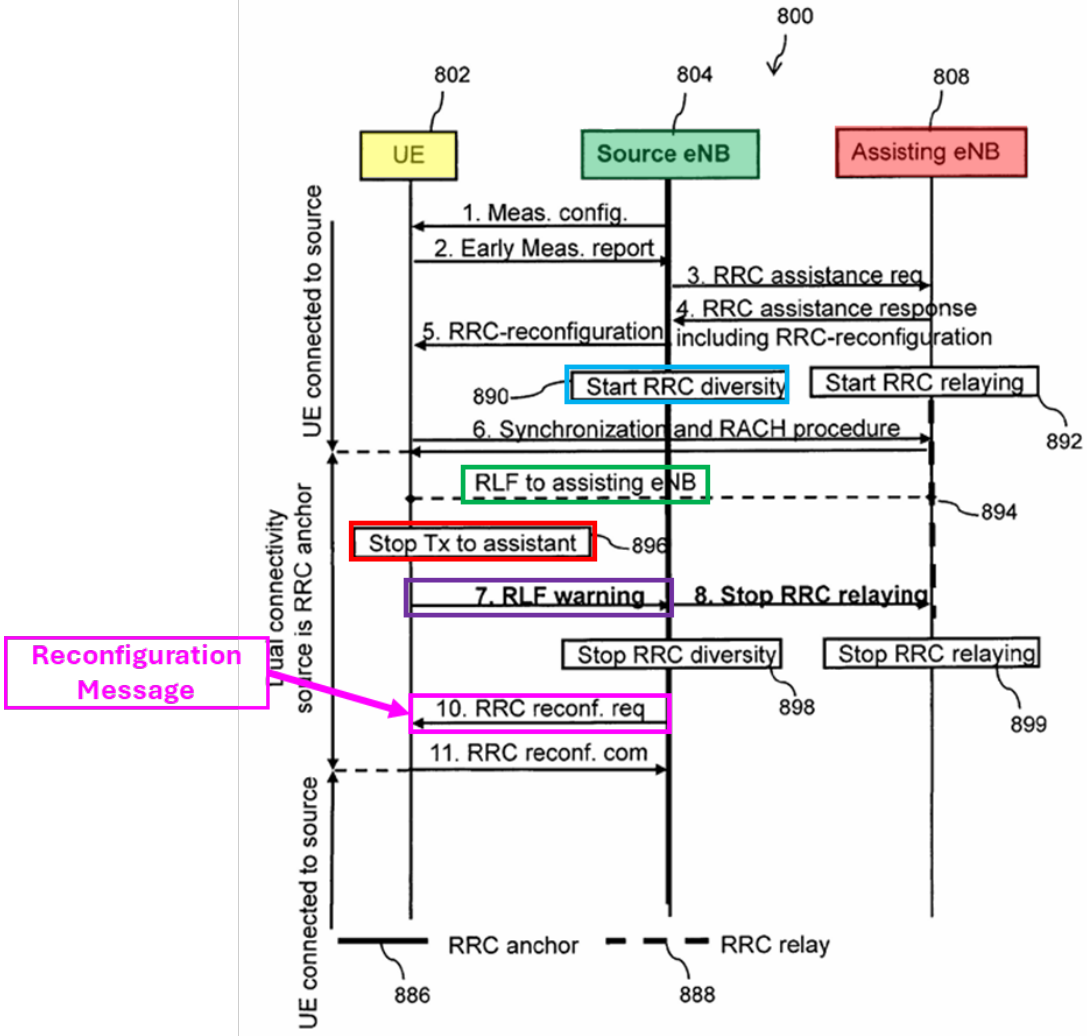


FIG. R – FIG. 8 of EX1004, Dudda (annotated)

122. The aforementioned RRC reconfiguration request from source eNodeB 804 includes information triggering UE 802 to deconfigure the assisting cell (corresponding to the claimed "*secondary service cell*"). Dudda provides that the RRC reconfiguration request is part of the procedure used to deconfigure the assisting cell. EX1004, 19:3-8 ("The source eNB 804 uses the RRC reconfiguration procedure (10, 11) to reconfigure the UE 802 to leave RRC diversity mode and be solely connected to the source cell."), 24:35-42; EX1005, 12:22-26, 20:14-19.

Because the RRC reconfiguration request causes the UE 802 to leave RRC diversity mode and be solely connected to the source cell, a POSITA would have understood, or at least found it obvious, that the RRC reconfiguration request includes RRC-related parameters for deconfiguring the assisting cell, which is the claimed "*secondary serving cell deconfiguration information for the secondary serving cell*".

[2.b] wherein the processor is configured to deconfigure the secondary serving cell at the user equipment side based on the secondary serving cell deconfiguration information.

123. Dudda discloses, or at least suggests, that processor 1005 of UE 802 is further configured to deconfigure the assisting cell (corresponding to the claimed "*secondary serving cell*") by reconfiguring the RRC-related parameters based on the information in the RRC reconfiguration request (corresponding to the claimed "*secondary serving cell deconfiguration information*").

124. Dudda discloses that its UE 802 receives an RRC reconfiguration request in step 10 from source eNodeB 804 and then sends an RRC reconfiguration complete/command in step 11 to source eNodeB 804, such that UE 802 is solely connected to the source cell (*i.e.*, disconnected from secondary cell) after reconfiguration procedure. EX1004, 18:43-46, 19:3-8; EX1005, 12:22-26. Accordingly, a POSITA would have understood that between steps 10 and 11, processor 1005 of Dudda's UE 802 deconfigures the assisting cell based on the information in the RRC reconfiguration request, *e.g.*, RRC-related parameters. This

process is annotated below in the orange box in FIG. S.

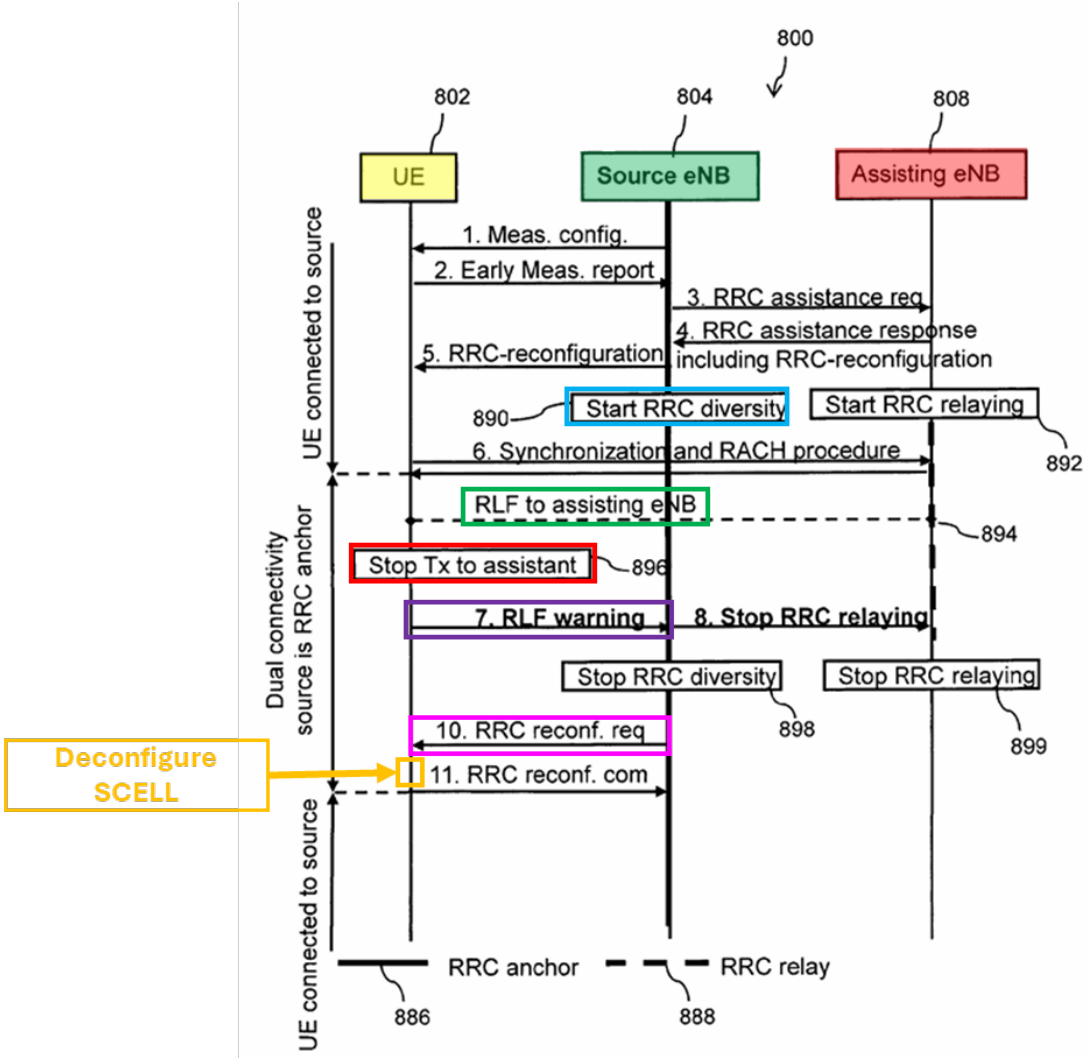


FIG. S – FIG. 8 of EX1004, Dudda (annotated)

125. Such a process is consistent with the teaching of the ’283 Patent, which describes that the UE deconfigures the secondary serving cell by performing “reconfiguration of the RRC related parameter of deconfiguring the secondary serving cell” and transmitting “an RRC connection reconfiguration complete message to the macro base station.” EX1001, 14:44-52.

C. Dependent Claim 3

126. Claim 3 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

> **[3.P]** The user equipment of claim 2, further comprising:
> **[3.a]** a receiving unit configured to receive a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station from the master base station,
> **[3.b]** wherein the processor is configured to detect the RLF for the secondary serving cell based on the radio link monitoring set.

[3.P] The user equipment of claim 2, further comprising:

127. Dudda discloses the apparatus of claim 2. I incorporate my discussion for claim 2.

> ***[3.a] a receiving unit configured to receive a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station from the master base station,***

128. As I discussed above in Section IX.B([2.a]), Dudda discloses reception unit 1013 as part of UE 802 for performing the functionality depicted in FIG. 8.

129. Dudda further discloses that reception unit 1013 (corresponding to the claimed "*receiving unit*") of UE 802 is configured to receive, from source eNodeB 804 (corresponding to the claimed "*master base station*"), a measurement

configuration (corresponding to the claimed "*radio link monitoring set*") including timers and constants to evaluate physical layer problems on a per-link basis (corresponding to the claimed "*radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station*").

130. I noticed that "***the** small base station*" lacks antecedent basis as it was not recited in the claims before. For purposes of this IPR, I have assumed that the phrase "*the small base station*" refers back to the "*secondary base station*" in claim 1, and also corresponds to assisting eNB (*e.g.*, 808) of Dudda. EX1004, 3:67-4:2; EX1005, 4:20-21.

131. Dudda discloses that "in a step 1, a measurement configuration is sent from the source eNodeB 804 [] to the user equipment 802 []" and that "UE 802 [] is first configured with a measurement configuration (1) issuing an early measurement report (2). This measurement may relate to a source cell, assisting cell or different cells." EX1004, 17:60-65, 18:14-17; EX1005, 11:28-30. The measurement configuration (*i.e.*, step 1) is annotated below in FIG. T in the black box.

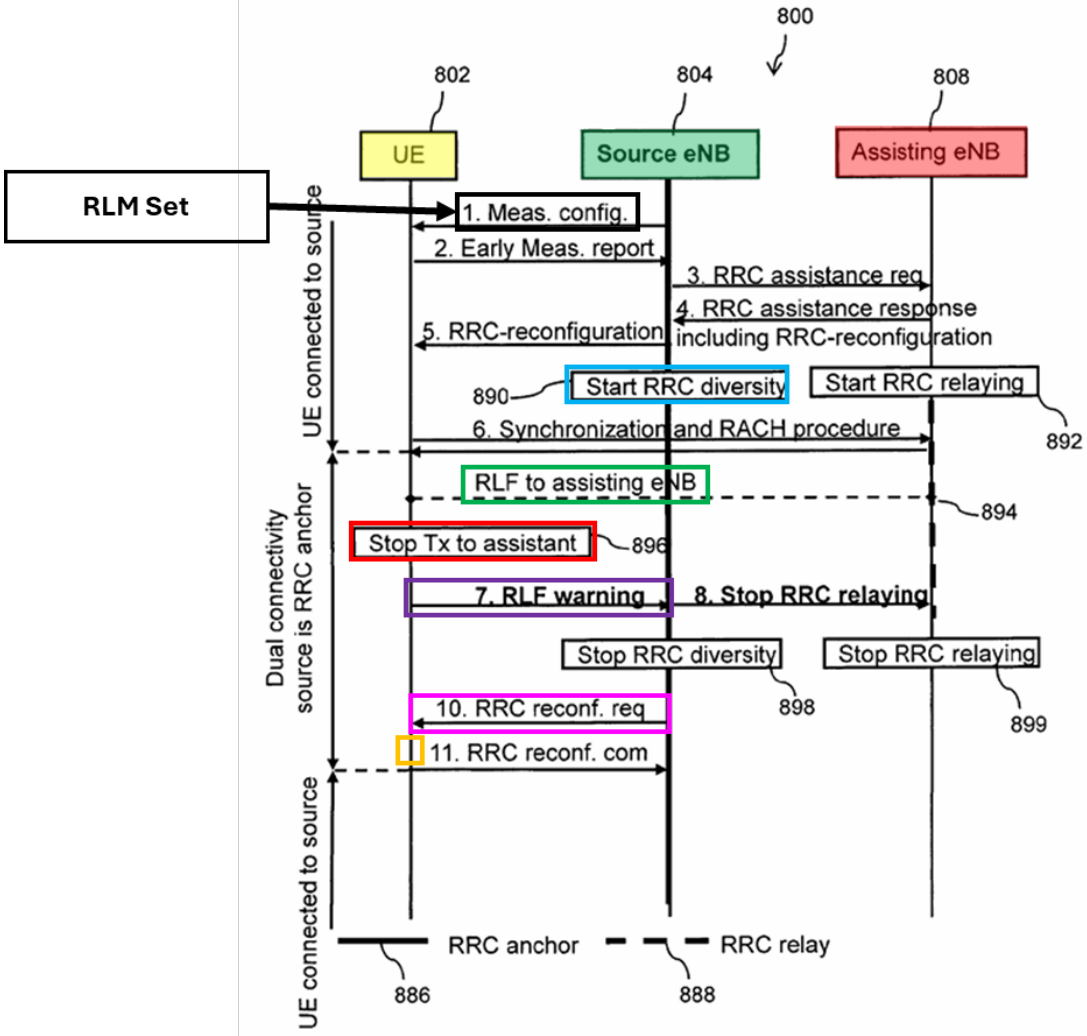


FIG. T – FIG. 8 of EX1004, Dudda (annotated)

132. A POSITA would have understood that Dudda's measurement configuration qualifies as the claimed "*radio link monitoring set*." Dudda discloses that the measurement configuration includes "timers and constants for the UE 802 [] to evaluate physical layer problems … configurable on a per link basis." EX1004, 20:26-39; EX1005, 14:11-23. The disclosed "per link basis" includes, for example, "relat[ing] to a source cell, assisting cell or different cells." EX1004, 18:16-17; EX1005, 11:28-30. Since timers and constants for evaluating physical layer

problems are cell radio link information, Dudda's measurement configuration is consistent with the '283 Patent's description that the "radio link monitoring set may include macro cell radio link information and at least one small cell radio link information." EX1001, 8:1-18 (describing "a physical problem detection timer T310" for radio link monitoring); 11:60-63.

133. A POSITA would have understood that the measurement configuration (corresponding to the claimed "*radio link monitoring set*") includes both the claimed "*radio link information for a primary serving cell provided by the master base station*" and "*radio link information for the secondary serving cell provided by the small base station*." This is because Dudda specifies that the timers and constants are "configurable on a per link basis" and provided to allow "the UE 802 [] to evaluate physical layer problems … **on a per link basis**," *e.g.*, "relate to **a source cell, assisting cell or different cells**," and Dudda describes how the UE 802 "evaluates separately per connected cell" the timers and constants provided in the measurement configuration (corresponding to the claimed "*radio link monitoring set*"). EX1004, 18:14-17, 20:26-39, 21:1-11; EX1005, 11:28-30, 14:11-23, 15:20-27.

[3.b] wherein the processor is configured to detect the RLF for the secondary serving cell based on the radio link monitoring set.

134. As I discussed above in Section IX.A([1.a]), Dudda discloses that processor 1005 of UE 802 is configured to detect an RLF for an assisting cell

(corresponding to the claimed "*secondary serving cell*"). I incorporate my discussion for Section IX.A([1.a]).

135. A POSITA would have understood that processor 1005 of UE 802 is further configured to detect the RLF for the assisting cell based on the measurement configuration (corresponding to the claimed "*radio link monitoring set*") because Dudda discloses that UE 802 evaluates physical layer problems, which corresponds to RLF detection, "on a per link basis," *e.g.*, "relate to a source cell, assisting cell or different cells," and "separately per connected cell" based on the timers and constants in the measurement configuration. EX1004, 18:14-17, 20:26-39, 21:1-11; EX1005, 11:28-30, 14:11-23, 15:20-27; *see* Section IX.C([3.a]).

D. Dependent Claim 4: *The user equipment of claim 1, wherein the processor is configured to detect the RLF for the secondary serving cell through radio link monitoring for the secondary serving cell.*

136. Dudda discloses the apparatus of claim 1. I incorporate my discussion for claim 1.

137. Dudda further discloses that its processor 1005 "*is configured to detect the RLF for the secondary serving cell through radio link monitoring for the secondary serving cell*" for the reasons provided in Section IX.C([3.b]). I incorporate my discussion of Section IX.C([3.b]).

E. Dependent Claim 5: ***The user equipment of claim 1, wherein the processor is configured to detect the RLF for the secondary serving cell based on a radio link control protocol data unit (RLC PDU) retransmission count for the secondary serving cell.***

138. Dudda discloses the apparatus of claim 1. I incorporate my discussion for claim 1.

139. Dudda discloses that processor 1005 of UE 802 is configured to trigger the new RLF-warning procedure (corresponding to the claimed "*detect the RLF for the secondary serving cell*") upon reaching the RLC maximum number of retransmissions (corresponding to the claimed "*based on a radio link control protocol data unit (RLC PDU) retransmission count for the secondary serving cell*"). Dudda provides that "[u]pon … RLC maximum number of retransmissions reached indication for this cell, the UE 802 [] shall trigger the new RLF-warning procedure as defined in the following." EX1004, 21:14-19; EX1005, 16:1-4. Dudda also discloses that "[a] further failure reason may comprise a maximum of retransmission of data having been sent by the terminal over the respective connection. … the latter may correspond in LTE to a **maximum number of RLC retransmissions having been reached**." EX1004, 13:27-34; EX1005, 20:25-26, 21:4.

140. Thus, a POSITA would have understood that the RLC maximum number of retransmissions in LTE, as disclosed by Dudda, qualifies as the claimed "*radio link control protocol data unit (RLC PDU) retransmission count*" and "this

cell" includes the assisting cell (corresponding to the claimed "*secondary serving cell*") on which RLF is detected.

F. Independent Claim 6

141. Claim 6 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

> **[6.P]** A master base station for performing radio link control in a wireless communication system supporting dual connectivity, the master base station comprising:
> **[6.a]** a receiving unit configured to receive a radio link failure (RLF) indicator indicating that a radio resource failure for a secondary serving cell provided to a user equipment occurs from a secondary base station from the user equipment;
> **[6.b]** a processor configured to generate a radio resource control (RRC) connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell based on the RLF indicator; and
> **[6.c]** a transmitting unit configured to transmit the RRC connection reconfiguration message to the user equipment,
> **[6.d]** wherein the RLF indicator comprises a cell identifier (cell ID), and
> **[6.e]** the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

[6.P] A master base station for performing radio link control in a wireless communication system supporting dual connectivity, the master base station comprising:

142. As discussed above in Sections IX.A([1.P]) and IX.A([1.b]), Dudda discloses a first access node, *e.g.*, anchor node 304a or source eNodeB 804 (corresponding to the claimed "*master base station"*) having radio link control (RLC) capability (corresponding to the claimed "*performing radio link control"*) in a system capable of dual connectivity (corresponding to the claimed "*wireless communication system supporting dual connectivity"*). I incorporate my analysis for Sections IX.A([1.P]) and IX.A([1.b]).

[6.a] a receiving unit configured to receive a radio link failure (RLF) indicator indicating that a radio resource failure for a secondary serving cell provided to a user equipment occurs from a secondary base station from the user equipment;

143. A POSITA would understand that Dudda's source eNodeB 804 (corresponding to the claimed "*master base station*") includes a reception unit 1113 (corresponding to the claimed "*receiving unit*"). With reference to FIG. 11, Dudda discloses that access node 1104 includes a reception unit 1113. EX1004, 26:12-14, 26:49-52, FIG. 11; EX1005, 23:6-16, FIG. 11. Dudda explains that "access node 1104 may correspond to the first access node 804," and that "access node 1104 is adapted to perform a method according to embodiments described above," including the method of adapting a mobile network in FIG. 8. EX1004, 26:12-14, 26:54-57; EX1005, 23:18-20. Accordingly, a POSITA would have understood that the

disclosures of FIG. 11 of Dudda apply to the source eNodeB 804 described in FIG. 8 and that Dudda's source eNodeB 804 includes reception unit 1113.

144. As I explained above in Sections IX.A([1.a]) and IX.A([1.b]), Dudda discloses that reception unit 1113 of source eNodeB 804 is configured to receive, from UE 802 (corresponding to the claimed "*user equipment*"), an RLF-warning message (corresponding to the claimed "*RLF indicator*") indicating that RLF for an assisting cell (corresponding to the claimed "*secondary serving cell*") provided to UE 802 occurs from assisting eNodeB 808 (corresponding to the claimed "*secondary base station*"). I incorporate my analysis for Sections IX.A([1.a]) and IX.A([1.b]).

[6.b] a processor configured to generate a radio resource control (RRC) connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell based on the RLF indicator;
and
[6.c] a transmitting unit configured to transmit the RRC connection reconfiguration message to the user equipment,

145. Dudda's source eNodeB 804 also includes a processor 1105 (corresponding to the claimed "*processor*") and a sending unit 1115 (corresponding to the claimed "*transmitting unit*"). EX1004, 26:12-14, 26:19-24, 26:49-52, FIG. 11; EX1005, 23:6-16, FIG. 11. As I explained above in Section IX.F([6.a]), Dudda's disclosures with respect to FIG. 11 apply to the source eNodeB 804 described in FIG. 8.

146. As I explained above in Section IX.B, Dudda discloses or at least suggests that processor 1105 of source eNodeB 804 is configured to generate an RRC reconfiguration request (corresponding to the claimed "*radio resource control (RRC) connection reconfiguration message*") including information triggering UE 802 to deconfigure the assisting cell (corresponding to the claimed "*secondary serving cell deconfiguration information for the secondary serving cell*"), *e.g.*, RRC related-parameter, in response to the RLF-warning message (corresponding to the claimed "*RLF indicator*"), as well as that sending unit 1115 of source eNodeB 804 is configured to transmit the RRC reconfiguration request to UE 802. I incorporate my analysis for Section IX.B.

[6.d] wherein the RLF indicator comprises a cell identifier (cell ID),

147. As I discussed above in Section IX.A([1.c]), Dudda discloses [6.d]. I incorporate my analysis for Section IX.A([1.c]).

[6.e]and the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

148. As I discussed above in Section IX.A([1.d]), Dudda discloses or at least suggests [6.e]. I incorporate my analysis for Section IX.A([1.d]).

G. Dependent Claim 7

149. Claim 7 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

[7.P] The base station of claim 6, wherein:

[7.a] the processor is configured to generate an indicator indicating the secondary base station to deconfigure the secondary serving cell for the user equipment, and

[7.b] the transmitting unit is configured to transmit the indicator to the secondary base station.

[7.P] The base station of claim 6, wherein:

150. Dudda discloses the apparatus of claim 6. I incorporate my discussion for claim 6.

[7.a] the processor is configured to generate an indicator indicating the secondary base station to deconfigure the secondary serving cell for the user equipment, and

151. Dudda discloses that processor 1105 of source eNodeB 804 is also configured to generate an indication to assisting eNB 808 to stop the RRC relaying functionally for UE 802 (corresponding to the claimed "*indicating the secondary base station to deconfigure the secondary serving cell for the user equipment*").

152. A POSITA would have understood, or at least found it obvious, that source eNB 804 indicates assisting eNB 808 to deconfigure the assisting cell to stop RRC diversity, leaving only the connection between source eNB 804 and UE 802. Specifically, as I have annotated in the blue box below in FIG. U, Dudda provides that "source eNB 804 will send an indication to the assisting eNB 808 to stop the RRC relaying functionality (8) for the UE 802, since it is aware of the UE 802 having triggered RLF to the assisting eNB 808." EX1004, 18:60-64; EX1005, 12:16-18.

Dudda explains that as a result of this procedure, "**in steps** 898, **899**, the source eNodeB 804 stops RRC diversity and **the assisting eNodeB 808 stops RRC relaying**," and "[o]nly the connection between source eNB 804 and UE 802 should be maintained, thus the UE 802 is configured to stop RRC diversity." EX1004, 18:40-42, 19:3-6; EX1005, 12:16-26.

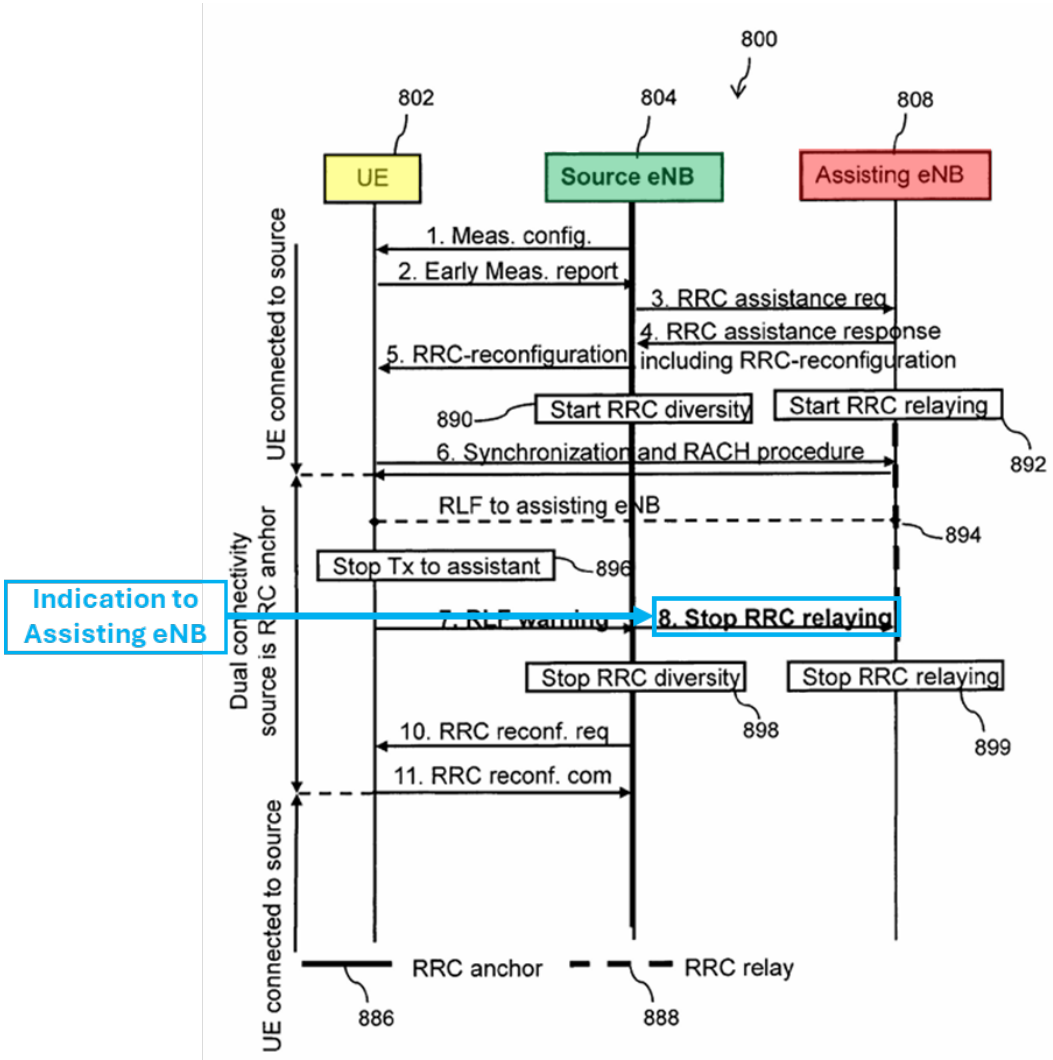


FIG. U – FIG. 8 of EX1004, Dudda (annotated)

153. Dudda also discloses deconfiguring the assisting cell (corresponding to the claimed "*secondary serving cell*") as one of the actions taken in response to RLF

detection, providing that "[t]he network may therefore deconfigure the assisting cell." EX1004, 24:35-42; EX1005, 20:14-19.

[7.b] the transmitting unit is configured to transmit the indicator to the secondary base station.

154. As I discussed above in Section IX.G([7.a]), Dudda discloses that sending unit 1115 (corresponding to the claimed "*transmitting unit*") of source eNodeB 804 is also configured to transmit the indication to assisting eNB 808 (corresponding to the claimed "*secondary base station*"). I incorporate my analysis for Section IX.G([7.a]).

H. Dependent Claim 8

155. Claim 8 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

[8.P] The base station of claim 6, wherein:
[8.a] the processor is configured to generate a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station,
[8.b] the transmitting unit is configured to transmit the generated radio link monitoring set to the user equipment, and
[8.c] the receiving unit is configured to receive the RLF indicator generated based on the radio link monitoring set.

[8.P] The base station of claim 6, wherein:

156. Dudda discloses the apparatus of claim 6. I incorporate my discussion

for claim 6.

[8.a] the processor is configured to generate a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station,

157. As I discussed above in Section IX.C([3.a]), Dudda discloses that processor 1105 of source eNodeB 804 is further configured to generate a measurement configuration (corresponding to the claimed "*radio link monitoring set*"), including timers and constants to evaluate physical layers problems on a per-link basis (corresponding to the claimed "*radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station*"). I incorporate my analysis for Section IX.C([3.a]).

[8.b] the transmitting unit is configured to transmit the generated radio link monitoring set to the user equipment, and

158. As I discussed above in Section IX.C([3.a]), Dudda discloses that sending unit 1115 (corresponding to the claimed "*transmitting unit*") of source eNodeB 804 is further configured to send the measurement configuration (corresponding to the claimed "*radio link monitoring set*") to UE 802. I incorporate my analysis for Section IX.C([3.a]).

[8.c] the receiving unit is configured to receive the RLF indicator generated based on the radio link monitoring set.

159. As I discussed above in Sections IX.C([3.b]) and IX.F([6.a]), Dudda

further discloses that reception unit 1113 (corresponding to the claimed "*receiving unit*") of source eNodeB 804 is further configured to receive the RLF-warning message (corresponding to the claimed "*RLF indicator*") from UE 802, which is generated by UE 802 based on the measurement configuration (corresponding to the claimed "*radio link monitoring set*"). I incorporate my analysis for Sections IX.C([3.b]) and IX.F([6.a]).

I. Independent Claim 9

160. Claim 9 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

> **[9.P]** A method for radio link control by a user equipment which is dually connected to a master base station and a secondary base station, the method comprising:
> **[9.a]** detecting a radio link failure (RLF) for a secondary serving cell provided by a secondary base station;
> **[9.b]** generating an RLF indicator indicating occurrence of the RLF for the secondary serving cell when the RLF for the secondary serving cell is detected; and
> **[9.c]** transmitting the RLF indicator to the master base station connected through radio resource control (RRC),
> **[9.d]** wherein the RLF indicator comprises a cell identifier (cell ID), and
> **[9.e]** the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH),

and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

[9.P] A method for radio link control by a user equipment which is dually connected to a master base station and a secondary base station, the method comprising:

161. Dudda discloses [9.P], which is substantially the same as [1.P]. *See* Section IX.A([1.P]). Specifically, Dudda discloses that FIG. 8 illustrates "a method for adapting a mobile network." EX1004, 9:36-37; EX1005, 10:9-10.

[9.a] detecting a radio link failure (RLF) for a secondary serving cell provided by a secondary base station; and
[9.b] generating an RLF indicator indicating occurrence of the RLF for the secondary serving cell when the RLF for the secondary serving cell is detected;

162. Dudda discloses [9.a] and [9b], which are substantially the same as [1.a]. *See* Section IX.A([1.a]).

[9.c] transmitting the RLF indicator to the master base station connected through radio resource control (RRC),

163. Dudda discloses [9.c], which is substantially the same as [1.b]. *See* Section IX.A([1.b]).

[9.d] wherein the RLF indicator comprises a cell identifier (cell ID), and

164. Dudda discloses [9.d], which is the same as [1.c]. *See* Section IX.A([1.c]).

[9.e] the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

165. Dudda discloses or at least suggests [9.e], which is the same as [1.d]. *See* Section IX.A([1.d]).

J. Dependent Claim 10

166. Claim 10 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

[10.P] The method of claim 9, further comprising:

[10.a] receiving an RRC connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell from the master base station; and

[10.b] deconfiguring the secondary serving cell at the user equipment side based on the secondary serving cell deconfiguration information.

[10.P] The method of claim 9, further comprising:

167. Dudda discloses the apparatus of claim 9. I incorporate my discussion for claim 9.

[10.a] receiving an RRC connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell from the master base station; and

168. Dudda discloses or at least suggests [10.a], which is substantially the same as [2.a]. *See* Section IX.B([2.a]).

[10.b] deconfiguring the secondary serving cell at the user equipment side based on the secondary serving cell deconfiguration information.

169. Dudda discloses or at least suggests [10.b], which is substantially the same as [2.b]. *See* Section IX.B([2.b]).

K. Dependent Claim 11: The method of claim 9, wherein the detection of the RLF for the secondary serving cell is performed based on radio link monitoring for the secondary serving cell.

170. Dudda discloses claim 11, which is substantially the same as claim 4. *See* Section IX.D.

L. Dependent Claim 12

171. Claim 12 is reproduced below. For ease of discussion, I have included a label for each claim limitation.

[12.P] The method of claim 11, further comprising:

[12.a] receiving a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station from the master base station,

[12.b] wherein the radio link monitoring for the secondary serving cell is performed based on the radio link monitoring set.

[12.P] The method of claim 11, further comprising:

172. Dudda discloses the apparatus of claim 11. I incorporate my discussion for claim 11.

[12.a] receiving a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station from the master base station,

173. Dudda discloses [12.a], which is substantially the same as [3.a]. *See* Section IX.C([3.a]).

[12.b] wherein the radio link monitoring for the secondary serving cell is performed based on the radio link monitoring set.

174. Dudda discloses [12.b], which is substantially the same as [3.b]. *See* Section IX.C([3.b]).

M. Dependent Claim 13: ***The method of claim 9, wherein the detection of the RLF for the secondary serving cell is performed based on a radio link control protocol data unit (RLC PDU) retransmission count for the secondary serving cell.***

175. Dudda discloses claim 13, which is substantially the same as claim 5. *See* Section IX.E.

X. Ground 3: Dudda in View of Pelletier Renders Obvious Claims 1-13

176. As I discussed above in Section IX, Dudda discloses or otherwise renders obvious claims 1-13. To the extent further disclosures are required, Dudda in view of Pelletier renders these claims obvious in my opinion.

A. Reasons to Combine Dudda and Pelletier

177. As I discussed above in Section IX.A([1.d]), Dudda discloses or at least suggests that "*the user equipment stops uplink transmission of physical uplink*

shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell."

178. Additionally, a POSITA would have been motivated to combine Dudda and Pelletier for the reasons discussed below to arrive at the claimed invention requiring that "*the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell*" (referred to herein as the "stopping limitation").

1. A POSITA would have been motivated to combine Dudda and Pelletier because of the "interrelated teachings of multiple patents."

179. Dudda and Pelletier provide complementary teachings regarding the stopping limitation. While Dudda does not explicitly specify PUSCH, PUCCH, and SRS, it discloses that its UE stops uplink transmission to the assisting cell in response to RLF detection. *See* Section XI.A([1.d]). Pelletier not only teaches stopping uplink transmissions to the SCell (which is analogous to Dudda's assisting cell) in that same situation, but also explicitly teaches stopping uplink transmission for PUSCH, PUCCH, and SRS to the SCell. *See* Section VIII.C. A POSITA, reviewing Dudda's disclosures regarding RLF handling on the assisting cell alongside Pelletier's explicit teaching of stopping uplink transmission for PUSCH,

PUCCH, and SRS to the SCell in the same situation, would have understood that Dudda also stops uplink transmission of PUSCH, PUCCH, and SRS to the assisting cell when the UE stops the uplink transmission to the assisting cell with RLF.

180. Dudda, Pelletier, and the ’283 Patent are all in the same field because not only do they all relate to wireless communications, but specifically communications systems relating to LTE. EX1001, 1:18-22, 4:21-28; EX1004, 1:5-15; EX1005, 1:5-15; EX1007, [0002]-[0003]. Furthermore, all three documents describe methods of managing radio links under dual connectivity when an RLF occurs on one radio link. EX1001, 2:34-35; EX1004, 7:19-23; EX1005, 8:23-26; EX1007, [0102].

181. Indeed, both Dudda and Pelletier disclose substantially the same wireless communication system discussed in independent claims 1, 6, and 9 of the ’283 Patent, as shown in FIGs. H and J below: a wireless communication system supporting dual connectivity, with a UE (annotated in the yellow box) connected to both a master base station (annotated in the green box) and a secondary base station (annotated in the red box). *Compare* EX1004, FIG. 3; EX1005, FIG. 3 *with* EX1007, FIG. 1A; *see also* Sections VIII.A, VIII.C.

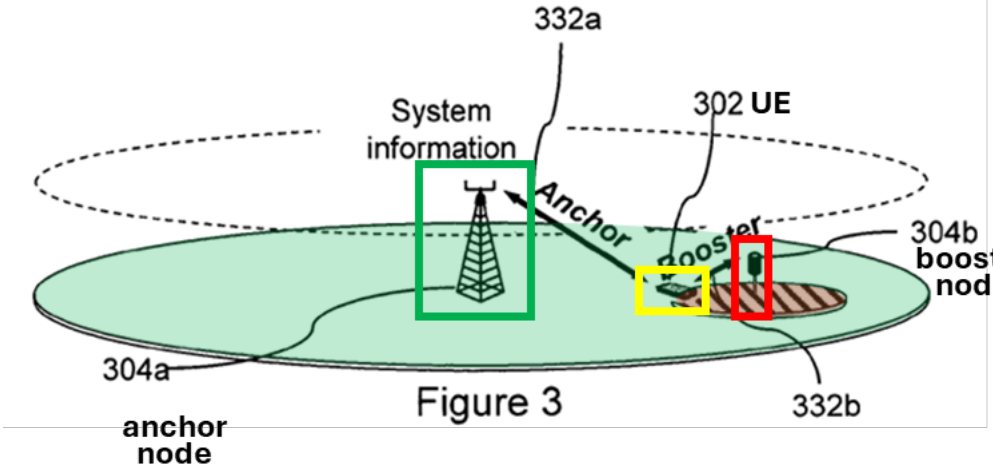


FIG. H – FIG. 3 of EX1004, Dudda (annotated)

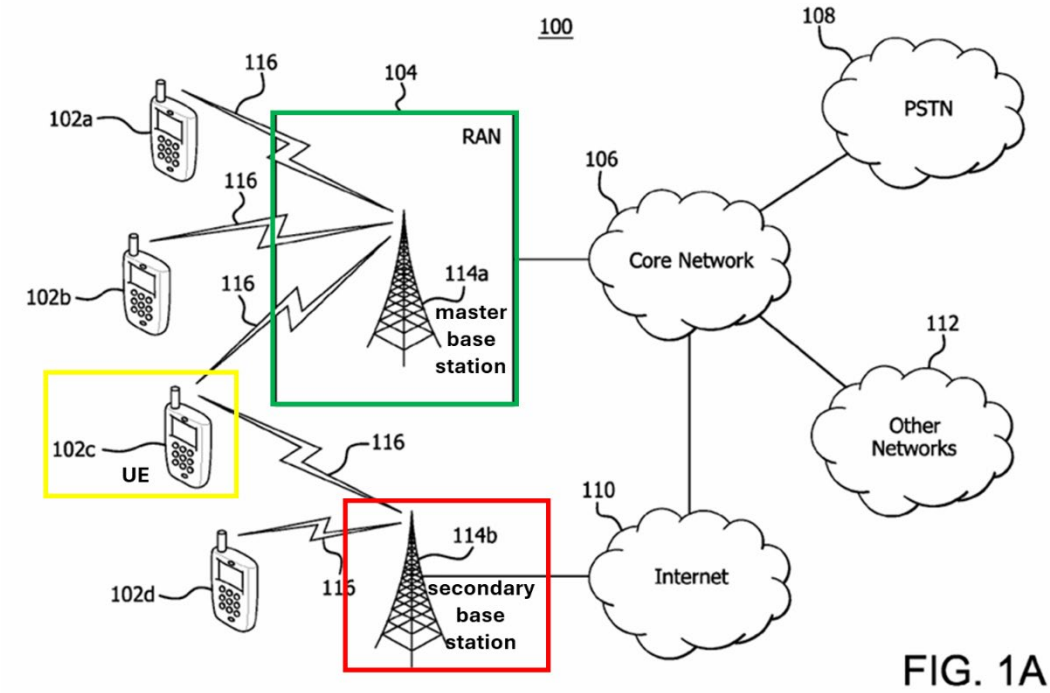


FIG. J – FIG. 1A of EX1007, Pelletier (annotated)

182. Furthermore, both Dudda and Pelletier disclose transmitting uplink user/payload data and control/signaling data to the secondary base station (annotated in the green boxes) in their wireless communication systems supporting dual connectivity. EX1004, 9:54-58, 28:35-51; EX1005, 25:28-26:10; EX1007, [0018],

[0021], [0040]. Moreover, both Dudda and Pelletier describe detecting RLF on the secondary base station/secondary serving cell in dual connectivity, as well as substantially the same reactions to the detected RLF, *i.e.*, stopping uplink transmission to the secondary base station/secondary serving cell. EX1004, 11:53-66, 18:35-38, 18:56-60, 21:31-59, 29:39-59; EX1005, 12:13-16, 16:21, 28:1-18; EX1007, [0102], [0120].

183. Accordingly, a POSITA would have been motivated to combine Dudda with Pelletier's interrelated teachings of the specific radio resources used for uplink transmission to the secondary serving cell, including the uplink resources of PUSCH, PUCCH, and SRS, which would have also been used in the uplink transmission of Dudda because those uplink resources are needed for uplink transmission. EX1007, [0040] (describing the necessity of PUSCH and PUCCH in user data and control data transmission), [0104] (describing SRS, PUSCH, and PUCCH as uplink resources affected by activation/deactivation of SCell); EX1011, § 8.2.3, pp. 123-124 (describing the necessity of PUSCH and PUCCH), § 11.2, pp. 210, 217 (describing the necessity of SRS).

184. For at least those reasons, a POSITA would have found it obvious to supplement Dudda's method for handling RLF on the assisting cell with Pelletier's express teaching of stopping uplink transmission of PUSCH, PUCCH, and SRS to the SCell when RLF is detected on the SCell, resulting in the claimed invention with

the stopping limitation.

2. Combining Dudda and Pelletier is merely applying Pelletier's known technique of starting/stopping uplink SRS transmission to SCell to Dudda's system for improvement to yield predicable results.

185. Pelletier describes a user equipment (WTRU) transmitting SRS over an SCell and stopping those SRS transmissions upon detecting an RLF related to the SCell. Specifically, Pelletier discloses "how a WTRU configured with at least one SCell … may determine whether or not it may transmit SRS on a configured periodic resource (or resources)" and that "for the purpose of determining whether or not to transmit SRS on a configured SR resource in a given UL CC, the WTRU **start (or continue) transmission of SRS** in the UL CC using the configured SRS resources … the WTRU may start …: upon (re)configuration of the UL CC not removing the UL CC; upon reception of a UL grant for a **PUSCH** for the UL CC; upon a **PUSCH transmission** on the UL CC." EX1007, [0117]-[0118]. Pelletier also discloses "[w]hen the WTRU deactivates a concerned SCell, the WTRU may stop any UL transmissions (UL-SCH, PUSCH, **SRS**) for the deactivated SCell UL after a time t." EX1007, [0120].

186. A POSITA would have understood that a CC in Pelletier corresponds to a cell. EX1007, [0041]-[0042] ("A cell typically minimally consists of a DL CC which is, optionally, linked to a UL CC"), [0044] ("referred to hereafter, the terms

'PCell DL' and 'PCell UL' correspond to, without loss of generality, the DL CC and the UL CC of the PCell, respectively. Similarly, the terms 'SCell DL' and 'SCell UL' correspond to the DL CC and the UL CC, if configured, of a SCell, respectively").

187. It is known in the art that SRS is "transmitted on the uplink to allow for the base station to estimate the uplink channel state at different frequencies. The channel-state estimates can then, for example, be used by the network scheduler to assign resource blocks of instantaneously good quality for uplink PUSCH transmission (uplink channel-dependent scheduling), as well as to select different transmission parameters such as the instantaneous data rate and different parameters related to uplink multi-antenna transmission." EX1011, § 11.2.2, p. 217. Furthermore, Pelletier discloses that WTRU employs uplink multi-antenna transmission. EX1007, [0025] ("WTRU 102 may include two or more transmit/receive elements 122, *e.g.*, multiple antennas, for transmitting and receiving wireless signals over the air interface 116."), [0032] ("eNode-B 140a, for example, may use multiple antennas to transmit wireless signals to, and receive wireless signals from, the WTRU 102a"); EX1011, § 5.2, p. 60 (discussing benefits of multi-antenna techniques). Accordingly, a POSITA would have understood that transmitting SRS in conjunction with PUSCH transmission improves multi-antenna wireless communication performance.

188. Furthermore, it is well known in the field that SRS is used for managing uplink time alignment, which is essential for maintaining proper synchronization of uplink transmissions. Uplink time alignment is a critical requirement for ensuring reliable PUSCH transmission, as it enables precise timing control to prevent interference and maintain network efficiency. EX1015, 11:14-22; EX1010, § 5.2, pp. 17-18; EX1011, § 11.5, pp. 245-246.

189. Therefore, a POSITA would have been motivated to apply Pelletier's known techniques of starting uplink SRS transmission to SCell for PUSCH transmission, and stopping SRS transmission upon SCell deactivation to Dudda's similar wireless communication system, such that Dudda's uplink transmission to the assisting cell includes SRS in conjunction with PUSCH, which would be stopped based on RLF on the assisting cell. A POSITA would have understood that implementing Pelletier's SRS transmission techniques in Dudda's wireless communication system predictably enhances the performance of Dudda's multi-antenna transmission system by employing the multi-antenna technique and allowing the network to manage uplink time alignment.

190. A POSITA would have a reasonable expectation of success in applying Pelletier's SRS transmission techniques to Dudda's system because of these similarities. *See* Section X.A1.

191. A POSITA would have readily been able to implement uplink

transmission of SRS alongside PUSCH in the assisting cell and subsequently stop both upon an RLF event, without undue burden and with a reasonable expectation of success. This follows from Pelletier's explicit teaching of various conditions for triggering SRS transmission in conjunction with PUSCH, providing clear and practical guidance for implementation. EX1007, [0118].

192. Furthermore, the integration of SRS transmission into Dudda's assisting cell is well within the capabilities of a POSITA, given the extensive body of knowledge available in the field. Established principles in wireless communication, as documented in textbooks, standards, and patents (*e.g.*, EX1007–EX1011 cited therein), provide ample support for implementing SRS transmission effectively. A POSITA would understand that SRS plays a crucial role in uplink transmission, aiding in channel state estimation, timing alignment, and resource allocation, all of which are essential for optimizing network performance.

193. Following Pelletier's teachings and leveraging common knowledge in the art, a POSITA could easily implement SRS transmission on Dudda's assisting cell in a manner that aligns with industry standards and best practices. Additionally, stopping SRS transmission upon RLF would be a logical and necessary step to prevent unnecessary uplink activity, avoid interference, and maintain network efficiency. Importantly, this combination would neither impair the functionality of Dudda's wireless communication system nor interfere with its RLF handling method.

Instead, it would enhance the robustness of the system by ensuring efficient resource management and seamless transition upon link failure.

B. Independent Claims 1, 6, and 9

194. To the extent that additional disclosures are required to disclose or suggest the stopping limitation in claims 1, 6, and 9 besides Dudda's disclosures and suggestions explained in Section IX.A([1.d]), Pelletier provides explicit teaching of this limitation. *See* Section VIII.C. Dudda discloses or at least suggests other limitations of claims 1, 6, and 9. *See* Sections IX.A, IX.F, IX.I. I incorporate my analysis for those sections. Accordingly, a POSITA would have been motivated to combine Dudda and Pelletier to arrive at the claimed invention recited in claims 1, 6, and 9. *See* Section X.A.

C. Dependent Claims 2-5, 7, 8, and 10-13

195. Claims 2-5, 7, 8, and 10-13 depend on independent claims 1, 6, and 9, respectively, and additionally require limitations that, as I discussed above, disclosed or at least suggested by Dudda. *See* Sections IX.B-IX.E, IX.G-IX.H, IX.J-IX.M. I incorporate my analysis for those sections.

XI. Grounds 4 and 5: Lin Alone or in View of Pelletier Renders Obvious Claims 1-13

A. Reasons to Combine Lin and Pelletier

196. To the extent Lin does not explicitly disclose the claimed hardware

components (*e.g.*, processor, transmitting unit, receiving unit) of the UE and master base station, and/or each claimed type of uplink transmission being stopped by the UE (*e.g.*, PUSCH, PUCCH, and SRS) in the stopping limitation, a POSITA would have been motivated to combine Lin and Pelletier to arrive at the claimed invention because of the interrelated teachings of multiple patents.

197. Lin and Pelletier provide complementary teachings regarding the stopping limitation. Lin explicitly teaches deactivating an SCell undergoing RLF. EX1006, [0063]-[0068]. Pelletier further explains the specific actions involved in such a deactivation, which include stopping PUSCH, PUCCH, and SRS transmissions. EX1007, [0047], [0085]-[0087], [0102], [0120]. A POSITA reviewing Lin's method of responding to an RLF in the SCell by deactivation alongside Pelletier's explicit teachings of stopping PUSCH, PUCCH, and SRS in the same situation would have found it obvious that the UE of Lin also stops uplink transmission of PUSCH, PUCCH, and SRS to the SCELL when the UE deactivates the SCELL on which RLF occurred.

198. This conclusion is bolstered by the fact that Lin, Pelletier, and the '283 Patent are all in the same field because not only do they all relate to wireless communications, but specifically communications systems relating to LTE. EX1001, 1:18-22, 4:21-28; EX1006, [0001]-[0002]; EX1007, [0002]-[0003]. Furthermore, all three documents are relevant to managing radio links under dual connectivity

when an RLF occurs on one radio link. EX1001, 2:34-35; EX1006, [0019]; EX1007, [0102].

199. Indeed, both Lin and Pelletier disclose substantially the same wireless communication system discussed in independent claims 1, 6, and 9 of the '283 Patent, as shown in FIGs. I and J below: a wireless communication system supporting dual connectivity, with a UE (annotated in the yellow box) connected to both a master base station (annotated in the green box) and a secondary base station (annotated in the red box). *Compare* EX1006, FIG. 2 *with* EX1007, FIG. 1A; *see* also Sections VIII.B, VIII.C.

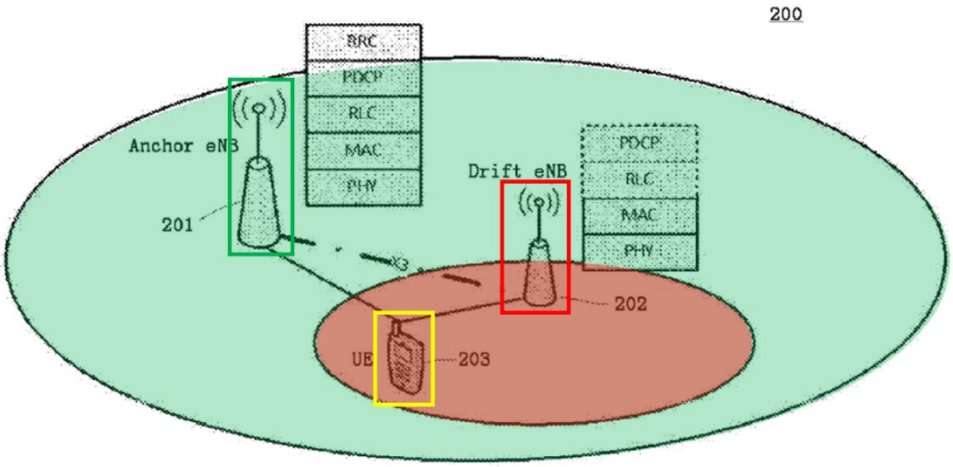


Fig. 2

FIG. I – FIG. 2 of EX1006, Lin (annotated)

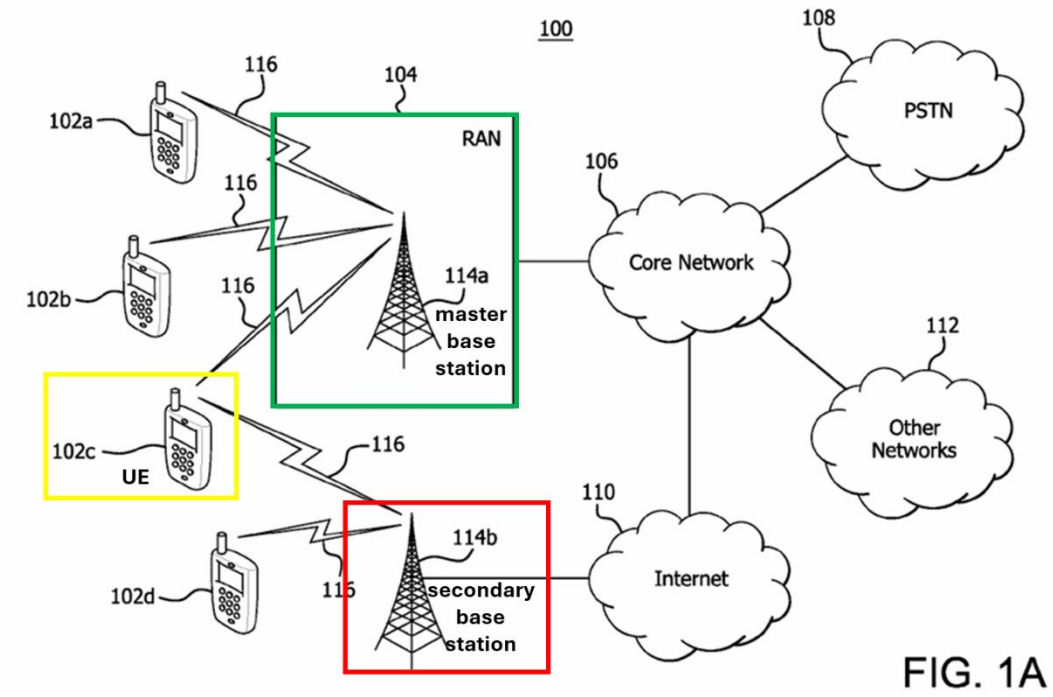


FIG. J – FIG. 1A of EX1007, Pelletier (annotated)

200. Furthermore, both Lin and Pelletier disclose transmitting uplink data to the secondary base station (annotated in the green boxes) in their wireless communication systems supporting dual connectivity. EX1006, [0081]; EX1007, [0018], [0021], [0040]. Both references describe detecting RLF on the secondary base station/secondary serving cell in dual connectivity, as well as substantially the same reactions to the detected RLF, including deactivating the secondary base station/secondary serving cell. EX1006, [0063]-[0069]; EX1007, [0102].

201. Pelletier explicitly describes stopping uplink transmissions such as PUSCH, PUCCH, and SRS when the SCell is deactivated, a principle that would naturally extend to Lin's system as well since Lin's system also deactivates SCELL

upon RLF. Accordingly, a POSITA would have been motivated to combine Lin with Pelletier's interrelated teaching of the specific types of uplink transmission to the SCell being stopped upon deactivating the SCell, including PUSCH, PUCCH, and SRS, which would have also happened to the SCELL in Lin.

B. Independent Claim 1

[1.P] A user equipment for performing radio link control in a wireless communication system supporting dual connectivity, the user equipment comprising:

202. Lin discloses a UE (corresponding to the claimed "*user equipment*") having radio link control (RLC) capability (corresponding to the claimed "*performing radio link control"*) in a system capable of dual connectivity (corresponding to the claimed "*wireless communication system supporting dual connectivity*").

203. FIG. 2 of Lin "is a diagram 200 that illustrates a procedure establishing a RRC connection to a radio access network in a wireless communication system in accordance with one novel aspect." EX1006, [0014]. FIG. 2 discloses a UE 203 establishing radio resource control to a radio access network by establishing, among other things, an RLC entity. EX1006, [0021]. It is well known in the art that the RLC entity is responsible for segmentation/concatenation, retransmission handling, duplicate detection, and in-sequence delivery to higher layers. *See* Section VI.C. Accordingly, a POSITA would understand that the UE 203 of Lin has radio link

control capability.

204. Lin provides various examples of UEs operating in a wireless communication system supporting dual connectivity. For example, as shown in FIG. I below, FIG. 2 of Lin depicts UE 203 (annotated in the yellow box) simultaneously connected to both an anchor eNB 201 and a drift eNB 202 (annotated in the green and red boxes, respectively). EX1006, [0021]-[0022]. Wireless communication system 200 in FIG. 2 is the claimed "*wireless communication system supporting dual connectivity*." Similarly, FIG. 3 depicts UE3 and UE4 simultaneously connected to both an anchor eNB 301 and a drift eNB 302. EX1006, [0030]. The system in FIG. 3 involving UE3/UE4, anchor eNB 301, and drift eNB 302 is also the claimed "*wireless communication system supporting dual connectivity*."

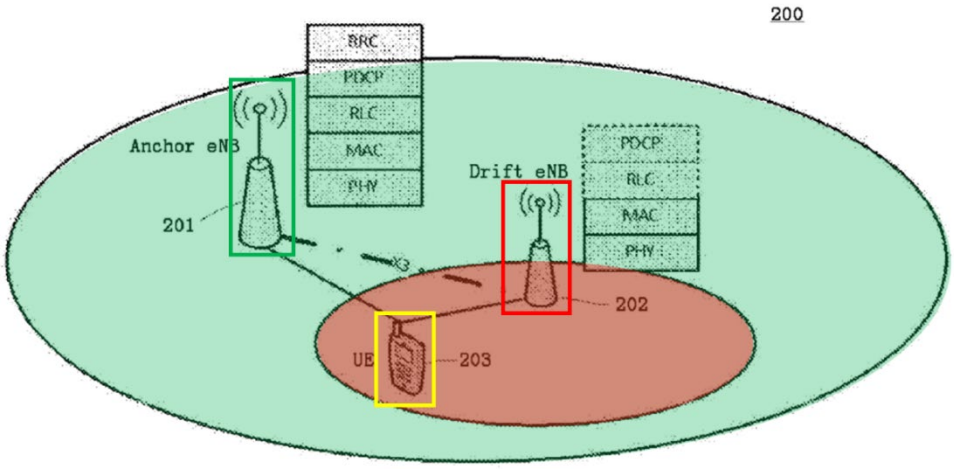


Fig. 2

FIG. I – FIG. 2 of EX1006, Lin (annotated)

[1.a] a processor configured to detect a radio link failure (RLF) for a secondary serving cell provided by a secondary base station (secondary eNB, SeNB) and to generate an RLF indicator indicating occurrence of the RLF for the secondary serving cell; and

205. Lin discloses that its UE is configured to detect an RLF for an SCELL provided by a drift eNB (corresponding to the claimed "*secondary base station (secondary eNB, SeNB)*"), and generate an RLF message/report (corresponding to the claimed "*RLF indicator*") indicating the occurrence of the RLF for the SCELL.

206. Specifically, in the sub-section titled "Report of RLF message," Lin discloses that "if RLF happens in the serving cells where RLM/RLF is performed, the **RLF message can be sent by the UE** … **[i]f the RLF happens in the drift eNB, the RLF report can be sent** through the anchor eNB." EX1006, [0051], [0053]-[0054]. This RLF report indicates the occurrence of the RLF for the SCELL. Lin provides, in the sub-section titled "RLF content," that "if the **RLF happens in the drift eNB**, the RLF should indicate the global cell identity, if available; otherwise the physical cell identity and/or carrier frequency of **the SCELL where radio link failure is detected** should be indicated." EX1006, [0057], [0060]. Moreover, in Claims 1 and 10, Lin further discloses "**monitoring** the performance for several radio links, cells or groups of cells; and taking action when the performance of a radio link, a cell or a group of cells is low, *e.g.*, **radio link failure**" and "the **UE sends the report of RLF message** to the base station with good link quality and UL

resource." EX1006, Claims 1, 10. Thus, a POSITA would have understood that Lin's UE (*e.g.*, UE 203, UE3, or UE4) is configured to detect an RLF for the SCELL provided by the drift eNB and to generate an RLF message/report upon RLF.

207. A POSITA would have also understood that, in Lin, the drift eNB (*e.g.*, 202 or 302) is the claimed "*secondary base station*." This is because "the SCELLs [are] in the drift eNB 202 for a specific UE," and also because the drift eNB plays a secondary role in a **UE anchor-based** architecture as it has to be relocated when the UE moves out of the local area, in contrast to the anchor eNB. EX1006, [0006]-[0007], [0025]. The term "UE anchor-based" as well as the fact that the drift eNB needs to be relocated make it clear that the anchor eNB plays the primary role while the drift eNB plays the secondary role in the communication architecture.

208. In order to execute this functionality, a POSITA would understand that Lin's UE has a processor. Furthermore, Lin discloses that MAC, PHY, RLC, and PDCP entities are established on the UE side to enable data transmission/reception through drift eNB 202, and the MAC entity can be implemented by software. EX1006, [0024]. Thus, a POSITA would have understood, or at least found it obvious, that Lin's UE includes a processor for implementing the MAC entity, as well as the PHY, RLC, and PDCP entities.

209. Additionally, Pelletier discloses a processor 118 of a WTRU (*e.g.*, a UE) implementing functions of the WTRU, including detecting RLF for an SCell

(corresponding to the claimed "*secondary serving cell*"). EX1007, [0022]-[0023], [0102], [0202], FIG. 1B. As I explained above in Section XI.A, a POSITA would have been motivated to combine Lin with Pelletier's teaching of hardware components, including processor 118 of the UE, such that Lin's UE also includes a processor (*e.g.*, processor 118 of Pelletier) to implement its disclosed functions, including RLF detection for the SCell, in view of the "interrelated teachings of multiple patents" from Lin and Pelletier.

[1.b] a transmitting unit configured to transmit the RLF indicator to a master base station (master eNB, MeNB) connected through radio resource control (RRC),

210. Lin discloses that the UE is configured to transmit the RLF message/report (corresponding to the claimed "*RLF indicator*") to an anchor eNB (corresponding to the claimed "*master base station (master eNB, MeNB)*") connected through radio resource control (RRC).

211. Lin discloses the UE transmitting the RLF message/report to an anchor eNB. In the sub-section titled "Report of RLF message," Lin discloses that "if RLF happens in the serving cells where RLM/RLF is performed, **the RLF message can be sent by the UE**" and specifically "[i]f the RLF happens in the drift eNB, **the RLF report can be sent through the anchor eNB**." EX1006, [0051], [0053]-[0054]. Lin also discloses, in the sub-section titled "Reaction to the RLF," that "**UE** deactivates the serving cell autonomously upon **transmission of the RLF report to the anchor**

eNB." EX1006, [0063], [0068]. Moreover, in "Network side behavior" under the sub-section of "Reactions to the RLF," Lin discloses that "a RLF message for the drift eNB is received by the anchor eNB." EX1006, [0076]-[0077].

212. A POSITA would have also understood that, in Lin, the anchor eNB (*e.g.*, 201 or 301) is the claimed "*master base station*." This is because the anchor eNB is where the primary cell (PCELL) is configured through. EX1006, [0021] ("a **primary cell (PCELL)** will be configured to a UE … responsible for the control and data transmission/reception through **the anchor eNB 201**"). Furthermore, Lin specifies that the anchor eNB plays a primary role in a **UE anchor-based** architecture and that the anchor eNB "does not have to be relocated when the UE moves in a local area covered by cells of multiple base-stations." EX1006, [0006]-[0007]. The term "UE anchor-based" as well as the fact that the anchor eNB does not need to be relocated make it clear that the anchor eNB plays the primary role while the drift eNB plays the secondary role in the communication architecture.

213. A POSITA would have further understood that Lin's UE is connected to the anchor eNB through radio resource control (RRC) connection. Lin provides that "[i]n a wireless network, a user equipment (UE) establishes a radio resource control (RRC) connection with a base station (eNB), which is UE anchor." EX1006, Abstract. Lin further discloses that "[w]hen a UE 203 establishes a radio resource control (RRC) to a radio access network, a primary cell (PCELL) will be configured

to a UE … responsible for the control and data transmission/reception through the anchor eNB 201." EX1006, [0021].

214. A POSITA would understand, or at least find it obvious, that Lin's UE contains a transmitting unit to enable the UE to perform its operations. Furthermore, Pelletier discloses that its WTRU contains a transceiver 120 for implementing the WTRU's functions, including communicating with base station 114a in RAN 104 (corresponding to the claimed "*master base station*"). EX1007, [0012], [0022], [0026], [0102], [0202]. Accordingly, a POSITA would have been motivated to combine Lin with Pelletier's teaching of hardware components, including transceiver 120 of the UE, such that Lin's UE also includes a transceiver (*e.g.*, transceiver 120 of Pelletier, corresponding to the claimed "*transmitting unit*") to implement its disclosed functions, including transmitting the RLF message/report to the anchor eNB, in view of the "interrelated teachings of multiple patents" from Lin and Pelletier. *See* Section XI.A.

[1.c] wherein the RLF indicator comprises a cell identifier (cell ID), and

215. In the sub-section titled "RLF content," Lin describes that its RLF message/report (corresponding to the claimed "*RLF indicator*") "should indicate in which serving cell … RLF occurs," *e.g.*, "the global cell identity, if available; otherwise the physical cell identity and/or carrier frequency of the SCELL where

radio link failure is detected should be indicated." EX1006, [0057]-[0060], Claim 11 ("the report of RLF message indicates in which serving cell … RLF occurs").

[1.d] the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

216. Lin alone or in view of Pelletier suggests the stopping limitation: "*the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell*."

217. With respect to SRS and PUCCH, Lin discloses that "**periodic CQI and SRS reporting** will be performed normally **on the SCELL** until the SCELL is deactivated by the network," and "[t]he RLM/RLF configured serving cell can be … a serving cell configured with **PUCCH** resource in a cell group." EX1006, [0025], [0034]. Lin also discloses the UE sending to the **drift eNB uplink data**, which is known in the art as being transmitted on PUSCH and PUCCH. EX1006, [0081]; EX1007, [0040]. Accordingly, a POSITA would understand that Lin at the very least suggests, if not discloses, uplink transmission of PUSCH, PUCCH, and SRS to the drift eNB on the SCELL.

218. A POSITA would have further understood that Lin, alone or in view of Pelletier, teaches or suggests stopping the PUSCH, PUCCH, and SRS transmissions

in the SCELL in response to an RLF detected in the SCELL, as explained below in detail for various reasons. Each of these reasons alone would be sufficient to explain that Lin alone or in view of Pelletier teaches or suggests stopping the PUSCH, PUCCH, and SRS transmissions based on SCELL RLF.

i. Preventing spontaneous UL transmissions

219. First, Lin explicitly teaches that, upon detecting RLF on the SCELL, stopping the UE from performing any spontaneous uplink transmissions, including PUCCH and SRS, to the SCELL. EX1006, Claims 1, 9 ("using a still usable Cell or Radio Link, **preventing spontaneous UL transmissions** (**PUCCH, SRS**, SPS)").

220. Besides the explicitly specified PUCCH and SRS, a POSITA would have understood that in this situation, the UE of Lin would also stop spontaneous PUSCH transmissions as well. This is because it is clear that the "spontaneous UL transmissions" refers to transmissions that are initiated by the UE. It is well known in the art that those transmissions are initiated via a contention-based random-access procedure (a.k.a. RACH procedure), which includes scheduled uplink transmission using UL-SCH by PUSCH. EX1004, 18:10-13, 18:28-30, 18:47-52 (describing spontaneous UL transmission initiated by RACH procedure); EX1005, 12:5-6; EX1009, § 5, p. 40 (indicating that "PUSCH carries the UL-SCH"), § 10.1.5, pp. 71-73 (describing scheduled UL transmission on UL-SCH as part of RACH procedure); EX1011, § 14.3, pp. 310-312 (describing RACH procedure being used for initial

access when establishing a radio link and transmission of UE identify to the network using UL-SCH). Lin itself also discloses, or at least suggests, the RACH procedure involved in its RLF detection. EX1006, [0003], Claim 8 ("uplink radio problem including radio link failure detection based on random access channel (RACH) failure detection").

221. Accordingly, a POSITA would have understood that preventing the initial spontaneous UL transmissions includes stopping contention-based random-access procedure, which in turn stops the UE from scheduled uplink transmission on UL-SCH via PUSCH (*i.e.*, "*stop[ping] uplink transmission of physical uplink shared channel (PUSCH)*").

222. Furthermore, Lin discloses that, should the conditions warrant it, uplink data is sent from the UE to the drift eNB via PUSCH. Specifically, Lin describes the UE sending uplink data to the drift eNB. EX1006, [0081] ("the anchor eNB also requests UL data which is received from the UE and buffered in the drift eNB to be delivered to the anchor eNB through the X3 interface").

223. Lin also discloses free multiplexing functionality. This functionality allows "the transmission path for each radio bearer can be selected dynamically based on the instantaneous channel and load conditions" such that "it is possible that all the radio bears including DRBs, SRB1 and SRB2 are transmitted through the drift eNB for load balance." EX1006, [0026]. Because it is well known in the art that the

data of DRBs (data radio bearers) and SRBs (signaling radio bearers) is transmitted on PUSCH, a POSITA would have understood this to mean that the UE could transmit PUSCH, which carries the data of DRBs and SRBs, to the drift eNB. EX1011, § 8.3, p. 125 (describing SRBs are mapped to CCCH and DCCH), FIGs. 8.5, 8.8 (illustrating radio bearers, including SRBs, are mapped to CCCH and DCCH logical channels, which are in turn mapped to PUSCH physical channel for UL transmission); EX1014, [0070] (describing SRBs are mapped to CCCH and DCCH logical channels).

224. Accordingly, a POSITA would have understood, or at least found it obvious, that PUSCH transmission for the data of DRBs and SRBs is also stopped in response to RLF on SCELL, just like the PUCCH and SRS transmissions, as explicitly disclosed by Lin.

ii. Disabling/releasing the corresponding MAC entity

225. Second, a POSITA would have understood Lin's disclosures regarding disabling/releasing the MAC entity that corresponds to the drift eNb to also teach or suggest stopping PUSCH, PUCCH, and SRS transmission from the UE to the RLF-affected SCELL.

226. In the sub-section titled "Reaction to the RLF," Lin discloses disabling/releasing the corresponding MAC entity for the drift eNB based on RLF detection on the SCELL of the drift eNB. EX1006, [0063], [0070]-[0071]. As

annotated below in FIG. V, UE3 and UE4 are in dual connectivity mode with the anchor eNB and drift eNB. EX1006, [0030]. In UE3, "MAC 2" (annotated in red) corresponds to "PHY 2" (annotated in green) for the drift eNB; in UE4, "MAC 2" (annotated in red) corresponds to "PHY 3" (annotated in green) for the drift eNB. EX1006, [0030].

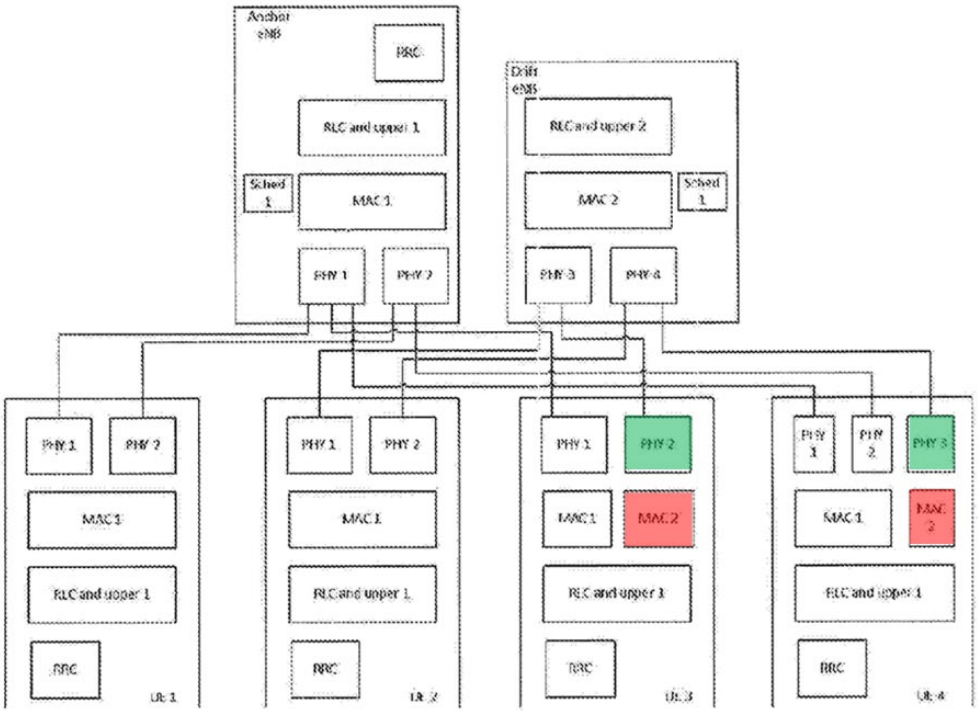


Fig. 4

FIG. V – FIG. 4 of EX1006, Lin (annotated)

227. The PHY entities (*e.g.*, PHY 2 or 3) displayed above are responsible for physical layer functions, including transmission using physical layer sources, such as PUSCH, PUCCH, and SRS transmissions. *See* Section VI.C.2. Disabling or

releasing the corresponding MAC entity (*e.g.*, MAC 2) for the drift eNB would cause the PHY entity to stop PUSCH, PUCCH, and SRS transmissions for at least the reasons discussed below.

228. It is well known in the art that the MAC layer handles various functions that are necessary for the corresponding physical layer to perform uplink transmission, such as uplink scheduling, logical channel multiplexing, MAC protocol data units (PDUs) assembling, uplink time alignment maintenance, etc. *See* Section VI.C.1; EX1010, § 4.2.1, p. 9, § 5.2, pp. 17-18, § 5.4, pp. 22-23, 25-26; EX1011, § 8.2.2, pp. 115-118; EX1017, § IV.A, p. 309. Specifically, (i) once the MAC entity is disabled or released, there would be no uplink scheduling grant received and decoded by MAC entity in order to prepare MAC PDUs; (ii) once the MAC entity is disabled or released, there would be no MAC PDUs assembled by MAC entity to be passed to the corresponding PHY entity for PUSCH and PUCCH transmissions since there would be no logical channel multiplexing or MAC PDU construction; (iii) once the MAC entity is disabled or released, there would be no uplink time alignment maintenance required for PUSCH, PUCCH, and SRS transmissions to ensure that the uplink transmissions from the UE remain synchronized with the base station. Therefore, it is clear that disabling or releasing the corresponding MAC entity for the drift eNB would cause the PHY entity to stop PUSCH, PUCCH, and SRS transmissions.

iii. Deactivating the RLF serving cell

229. Third, a POSITA would have understood Lin's disclosures relating to deactivating the serving cell from the drift eNB in the case of an RLF to teach or suggest stopping PUSCH, PUCCH, and SRS transmission from the UE to the affected SCELL. In the sub-section titled "Reaction to the RLF," Lin discloses deactivating the RLF serving cell from the drift eNB (*i.e.*, RLF SCELL). EX1006, [0063]-[0068].

230. A POSITA would have understood, or at least found it obvious, that deactivating an SCELL undergoing RLF includes stopping transmission of PUSCH, PUCCH, and SRS to the SCELL. PUSCH, PUCCH, and SRS transmissions to SCELL would not be possible and thus, be stopped upon SCELL deactivation in view of Lin's disclosure and common knowledge in the art. EX1007, [0040], [0104] (describing that uplink resources, including SRS, PUSCH, and PUCCH, are affected by deactivation of SCells); EX1009, § 5, pp. 40, 43-44. Since these uplink transmissions require an active SCELL to function, they would naturally cease upon SCELL deactivation. A POSITA would further recognize that stopping these transmissions is not only a logical consequence of deactivation but also necessary to prevent unnecessary uplink activity, mitigate interference, and maintain efficient network operation. EX1013, [0039].

231. Additionally, Pelletier teaches that "WTRU may also deactivate a

concerned SCell if the WTRU may detect RLF," "[w]hen the **WTRU deactivates a concerned SCell**, the WTRU may **stop any UL transmissions (UL-SCH, PUSCH, SRS**) for the deactivated SCell UL after a time t," and "a WTRU configured with at least one SCell may **not transmit SRS** for the concerned SCell when the concerned **SCell is deactivated** … a WTRU configured with at least one SCell may **not report CQI, PMI, or RI [(*i.e.*, signaling data sent on PUCCH)]** for the concerned SCell when the concerned **SCell is deactivated** … a WTRU configured with at least one SCell may **not transmit on PUSCH** for the SPS resources when the concerned **SCell is deactivated**." EX1007, [0047], [0085]-[0087], [0102], [0120].

232. As I discussed in Section XI.A above, a POSITA would have been motivated to combine Lin and Pelletier based on the "interrelated teachings of multiple patents." Accordingly, a POSITA would have found it obvious to supplement Lin's UE for deactivating the SCELL in response to RLF detection with Pelletier's express teaching of stopping uplink transmission of PUSCH, PUCCH, and SRS to the SCell as part of the deactivation actions.

C. Dependent Claim 2

[2.P] The user equipment of claim 1, further comprising:

233. Lin alone or in view of Pelletier suggests the apparatus of claim 1. I incorporate my discussion for claim 1.

[2.a] a receiving unit configured to receive an RRC connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell from the master base station,
and
[2.b] wherein the processor is configured to deconfigure the secondary serving cell at the user equipment side based on the secondary serving cell deconfiguration information.

234. Lin discloses that the UE is configured to receive, from the anchor eNB (corresponding to the claimed "*master base station*"), an RRC reconfiguration message/command (corresponding to the claimed "*RRC connection reconfiguration message*"), including information for SCELL removal, radio bearer reconfiguration, and SCELL reconfiguration *e.g.*, RRC-related parameters (corresponding to the claimed "*including secondary serving cell deconfiguration information for the secondary serving cell*"). Lin also discloses that the UE is configured to deconfigure the SCELL based on the information in the RRC reconfiguration message/command (corresponding to the claimed "*secondary serving cell deconfiguration information*").

235. Specifically, Lin discloses, in the sub-section titled "Reaction to the RLF," "UE deactivates/deconfigures the serving cell(s) upon reception of the explicit command received from the anchor eNB, *e.g.* RRC reconfiguration for SCELL removal," and "anchor eNB should send RRC message to the UE for radio bearer reconfiguration and SCELL reconfiguration" EX1006, [0063]-[0072],

[0077]-[0082].

236. Lin teaches that the RRC reconfiguration message/command is for "SCELL removal," "radio bearer reconfiguration," and "SCELL reconfiguration." EX1006, [0069]-[0070], [0082]. Therefore, a POSITA would have understood, or at least found it obvious, that, in order for the RRC reconfiguration message/command to trigger the UE to remove SECLL, reconfigure SCELL, and reconfigure radio bearer, the RRC reconfiguration message/command includes RRC-related parameters for deconfiguring the SCELL, which is the claimed "*secondary serving cell deconfiguration information for the secondary serving cell*," according to the '283 Patent. EX1001, 14:44-52; *see* Section IX.B.

237. Furthermore, a POSITA would understand, or at least find it obvious, that Lin's UE has a processor and a receiving unit to enable the UE to perform its operations for the reasons stated above. *See* Section XI.B([1.a]), XI.B([1.b]).

238. For example, Pelletier discloses processor 118 and transceiver 120 of a WTRU implementing functions of the WTRU, including communication with base station 114a in RAN 104. Pelletier, [0012], [0022]-[0023], [0026], [0102], [0202]. As I explained above in Section XI.A, a POSITA would have been motivated to combine Lin with Pelletier's teaching of hardware components, including processor 118 and transceiver 120 of the UE, such that Lin's UE also includes a processor (*e.g.*, processor 118 of Pelletier) and a transceiver (*e.g.*, transceiver 120 of Pelletier

"*receiving unit*") to implement its disclosed functions, including receiving the RRC reconfiguration message/command from the anchor eNB and deconfiguring the SCELL, in view of the "interrelated teachings of multiple patents" from Lin and Pelletier. *See* Section XI.A.

D. Dependent Claim 3

[3.P] The user equipment of claim 2, further comprising:

239. Lin alone or in view of Pelletier suggests the apparatus of claim 2. I incorporate my discussion for claim 2.

[3.a] a receiving unit configured to receive a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station from the master base station,

240. Lin discloses, or at least suggests, that the UE is configured to receive, from the anchor eNB (corresponding to the claimed *"master base station"*), radio link monitoring (RLM) parameters (corresponding to the claimed *"a radio link monitoring set"*), including values of constants and timers per serving cell (corresponding to the claimed *"radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station"*).

241. At the outset, I noticed that "***the*** *small base station*" lacks antecedent basis as it was not recited in the claims before. For purposes of this IPR, I have

assumed that the phrase "*the small base station*" refers back to the "*secondary base station*" in claim 1. This corresponds to the drift eNB of Lin. EX1006, [0006], [0030].

242. In the sub-section titled "**UE RLM** on multiple cells: **Configurable RLM/RLF**," Lin describes the network configuring the radio link monitoring set, providing that "[t]he values of constants and timers controlling the RLM/RLF on the serving cells, on which RLM/RLF is performed, should be **configured by the network** through RRC message," and that "[t]he parameters for RLM/RLF constants and timers can be configured **per serving cell**, *i.e.* the **network configures separate values** for RLM/RLF constants and timers **for each serving cell**, in which RLM/RLF will be performed." EX1006, [0032], [0045]-[0048]. Lin also provides that "[i]f the SCELL is not the first cell activated in a group, the **configuration of RLM/RLF on this cell can be decided by eNB**." EX1006, [0038]. The title "UE RLM" clearly indicates that the RLM parameters are received by the UE for the UE to perform RLM.

243. A POSITA would have understood that Lin's RLM parameters qualify as the claimed "*radio link monitoring set*." Lin discloses that the RLM parameters include "values of constants and timers controlling the RLM/RLF" and "can be configured per serving cell." EX1006, [0045]-[0048]. Since constants and timers for controlling the RLM/RLF are cell radio link information, Lin's RLM parameters are

consistent with the '283 Patent's description that the "radio link monitoring set may include macro cell radio link information and at least one small cell radio link information." EX1001, 8:1-18 (describing "a physical problem detection timer T310" for radio link monitoring); 11:60-63.

244. Accordingly, a POSITA would have understood, or at least found it obvious, that the network/eNB configures the parameters for RLM/RLF constants and timers and sends them to the UE for the UE to perform RLM on PCELL and SCELL, respectively.

245. Furthermore, a POSITA would have understood, or at least found it obvious, that the anchor eNB configures and sends the RLM parameters for the drift eNB. As I discussed above, the anchor eNB plays the primary role, while the drift eNB plays the secondary role. *See* Sections XI.B([1.a]), XI.B([1.b]). Moreover, Lin describes that the anchor eNB actively performs various actions to control the overall network, while the drift eNB passively acts based on the anchor eNB's instructions. EX1006, [0076]-[0087]. In light of these disclosures, it would have been obvious for a POSITA to use the anchor eNB, instead of the drift eNB, to configure and send the RLM parameters. EX1004, 17:60-65 (describing source eNB 804 sending measurement configuration to UE 802), FIG. 8; EX1005, FIG. 8.

246. In the same sub-section of "UE RLM on multiple cells: Configurable RLM/RLF," Lin provides various examples where the "RLM/RLF mechanism can

be configured to one or more than one serving cell(s)," wherein one such example teaches that "the **anchor eNB** can configure serving cells in the anchor eNB form a TAG and serving cells in the drift eNB form another TAG." EX1006, [0032]-[0033], [0036]. This further confirms that the anchor eNB, as opposed to the drift eNB on the network side, provides the RLM parameters.

247. As I discussed above, Lin alone or in view of Pelletier suggests the claimed "*receiving unit*" of the UE. *See* Section XI.C.

[3.b] wherein the processor is configured to detect the RLF for the secondary serving cell based on the radio link monitoring set.

248. A POSITA would have understood that Lin alone or in view of Pelletier suggests that the processor of the UE is configured to detect the RLF for the SCELL based on the RLF parameters (corresponding to the claimed "*radio link monitoring set*"). As I explained above in Section XI.A([1.a]), Lin alone or in view of Pelletier suggests that the processor of the UE is configured to detect an RLF for an SCELL. Lin further discloses that the RLF parameters are configured "per serving cell" with "separate values for RLM/RLF constants and timers for each serving cell, in which RLM/RLF will be performed." EX1006, [0048].

E. Dependent Claim 4: The user equipment of claim 1, wherein the processor is configured to detect the RLF for the secondary serving cell through radio link monitoring for the secondary serving cell.

249. Lin alone or in view of Pelletier suggests the apparatus of claim 1. I

incorporate my discussion for claim 1.

250. Lin alone or in view of Pelletier further suggests that its processor 1005 "*is configured to detect the RLF for the secondary serving cell through radio link monitoring for the secondary serving cell*" for the reasons provided in Section XI.D. I incorporate my discussion of Section XI.D.

F. Dependent Claim 5: *The user equipment of claim 1, wherein the processor is configured to detect the RLF for the secondary serving cell based on a radio link control protocol data unit (RLC PDU) retransmission count for the secondary serving cell.*

251. Lin alone or in view of Pelletier suggests the apparatus of claim 1. I incorporate my discussion for claim 1.

252. Lin discloses that one of the triggers for RLF is based on reaching the maximum number of retransmissions. For example, Lin provides that "the UE generally **consider radio link failure (RLF) to be detected upon** physical layer problems based on … indication from RLC layer that the **maximum number of retransmission[s] has been reached**." EX1006, [0003]. Lin further describes "retransmission failure" as a cause of RLF failure. Lin, [0061] ("**the triggering of radio link failure, *i.e.*,** DL out of sync, RACH failure, **retransmission failure** should be indicated, and/or other causes of RLF."), Claim 8 ("the radio link failure involves … maximum number of radio link control (RLC) retransmissions").

G. Independent Claim 6

[6.P] A master base station for performing radio link control in a wireless communication system supporting dual connectivity, the master base station comprising:

253. As I discussed above in Sections XI.B([1.P]) and XI.B([1.b]), Lin discloses an anchor eNB (*e.g.*, 201 or 301) (corresponding to the claimed "*master base station"*) having radio link control (RLC) capability (corresponding to the claimed "*performing radio link control"*) in a system capable of dual connectivity (corresponding to the claimed "*wireless communication system supporting dual connectivity"*).

[6.a] a receiving unit configured to receive a radio link failure (RLF) indicator indicating that a radio resource failure for a secondary serving cell provided to a user equipment occurs from a secondary base station from the user equipment;

254. As explained above in Sections XI.B([1.a]) and XI.B([1.b]), Lin discloses that the anchor eNB is configured to receive, from the UE (corresponding to the claimed "*user equipment*"), an RLF message/report (corresponding to the claimed "*RLF indicator*") indicating that RLF for an SCELL (corresponding to the claimed "*secondary serving cell*") provided to the UE occurs from the drift eNB (corresponding to the claimed "*secondary base station*"). EX1006, [0051], [0053]-[0054], [0063], [0068]. Moreover, in the sub-section titled "Network side behavior" under "Reactions to the RLF," Lin discloses that "if a RLF message for the drift eNB is received by the anchor eNB, the anchor eNB should take the following actions."

EX1006, [0076]-[0077].

255. A POSITA would have understood, or at least found it obvious, that Lin's anchor eNB has a receiving unit to enable the anchor eNB to perform its operations. For example, Pelletier discloses "base station 114a may include three **transceivers**, *i.e.*, one for each sector of the cell." EX1007, [0012]. Accordingly, a POSITA would have been motivated to combine Lin with Pelletier's teaching of hardware components, including the transceiver of base station 114a (corresponding to the claimed "*master base station*"), such that Lin's anchor eNB also includes a transceiver (corresponding to the claimed "*receiving unit*") to implement its disclosed functions, including receiving the RLF message/report from the UE, in view of the "interrelated teachings of multiple patents" from Lin and Pelletier. *See* Section XI.A.

> ***[6.b] a processor configured to generate a radio resource control (RRC) connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell based on the RLF indicator;***
> ***and***
> ***[6.c] a transmitting unit configured to transmit the RRC connection reconfiguration message to the user equipment,***

256. As I explained above in Section XI.C, Lin discloses that the anchor eNB is configured to generate an RRC reconfiguration message/command (corresponding to the claimed "*radio resource control (RRC) connection reconfiguration message*"), including information triggering the UE to deconfigure

and remove the SCELL (corresponding to the claimed "*secondary serving cell deconfiguration information for the secondary serving cell*"), *e.g.*, RRC related-parameter, in response to the RLF message/report (corresponding to the claimed "*RLF indicator*"), as well as transmit the RRC reconfiguration message/command to the UE.

257. A POSITA would have understood, or at least found it obvious, that Lin's anchor eNB has a processor and a transmitting unit to enable the anchor eNB to perform its operations. For example, Pelletier discloses "base station 114a may include three **transceivers**, *i.e.*, one for each sector of the cell" and "[a] **processor** in association with software may be used to implement a radio frequency **transceiver** for use in a WTRU, UE." EX1007, [0012], [0202]. Accordingly, a POSITA would have been motivated to combine Lin with Pelletier's teaching of hardware components, including the processor and transceiver of base station 114a, such that Lin's anchor eNB also includes a processor and a transceiver (corresponding to the claimed "*transmitting unit*") to implement its disclosed functions, including generating and transmitting the RRC reconfiguration message/command, in view of the "interrelated teachings of multiple patents" from Lin and Pelletier. *See* Section XI.A.

[6.d] wherein the RLF indicator comprises a cell identifier (cell ID), and

258. As I discussed above in Section XI.B([1.c]), Lin discloses the claimed "*RLF indicator comprises a cell identifier (cell ID).*"

[6.e] the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

259. As I discussed above in Section XI.B([1.d]), Lin alone or in view of Pelletier suggests that "*the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell*."

H. Dependent Claim 7

[7.P] The base station of claim 6, wherein:

260. Lin alone or in view of Pelletier suggests the apparatus of claim 6. I incorporate my discussion for claim 6.

[7.a] the processor is configured to generate an indicator indicating the secondary base station to deconfigure the secondary serving cell for the user equipment, and
[7.b] the transmitting unit is configured to transmit the indicator to the secondary base station.

261. Lin discloses that the anchor eNB is further configured to generate an RLF indication (corresponding to the claimed "*indicator*") with UE identification,

informing the drift eNB (corresponding to the claimed "*secondary base station*") that RLF on the SCELL has occurred for the UE to deconfigure the SCELL, as well as to transmit the RLF indication to the drift eNB.

262. Specifically, in the "Reactions to the RLF" sub-section under "Network side behavior," Lin discloses "if a RLF message for the drift eNB is received by the anchor eNB, the anchor eNB should … deconfigure the corresponding serving cell," "inform[] to the drift eNB that RLF on the serving cells … generated from the drift eNB has occurred for a specific UE, and the UE identification is also indicated," and "[u]pon the RLF indication with the UE identification from the anchor eNB, the drift eNB forwards the UL data which is received from the UE and buffered to the anchor eNB through the X3 interface … also release the MAC entity which is responsible for data transmission to the UE." EX1006, [0076]-[0079], [0083].

263. Furthermore, as I discussed above in Section XI.G([6.b]-[6.c]), Lin alone or in view of Pelletier suggests the claimed "*processor*" and "*transmitting unit*" of the anchor eNB, which can be configured to generate and transmit the RLF indication.

I. Dependent Claim 8

[8.P] The base station of claim 6, wherein:

264. Lin alone or in view of Pelletier suggests the apparatus of claim 6. I incorporate my discussion for claim 6.

[8.a] the processor is configured to generate a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station,
[8.b] the transmitting unit is configured to transmit the generated radio link monitoring set to the user equipment, and

265. As I discussed above in Section XI.D, Lin discloses that the anchor eNB is further configured to generate RLM parameters (corresponding to the claimed "*radio link monitoring set*"), including values of constants and timers per serving cell (corresponding to the claimed "*radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station*"), and to transmit the RLM parameters to the UE (corresponding to the claimed "*transmit the generated radio link monitoring set to the user equipment*").

266. As I discussed above in Section XI.G([6.b]-[6.c]), Lin alone or in view of Pelletier suggests the claimed "*processor*" and "*transmitting unit*" of the anchor eNB, which can be configured to generate and transmit the RLM parameters.

[8.c] the receiving unit is configured to receive the RLF indicator generated based on the radio link monitoring set.

267. As I discussed above in Sections XI.D and XI.G([6.a]), Lin alone or in view of Pelletier suggests that the receiving unit of the anchor eNB is further configured to receive the RLF message/report (corresponding to the claimed "*RLF indicator*") from the UE, which is generated based on the RLM parameters

(corresponding to the claimed "*radio link monitoring set*").

J. Independent Claim 9

[9.P] A method for radio link control by a user equipment which is dually connected to a master base station and a secondary base station, the method comprising:

268. Lin discloses [9.P], which is substantially the same as [1.P]. *See* Section XI.B([1.P]). Specifically, Lin discloses a "method of radio link monitoring (RLM) and radio link failure (RLF) handling over a small cell network." EX1006, Abstract.

[9.a] detecting a radio link failure (RLF) for a secondary serving cell provided by a secondary base station; and
[9.b] generating an RLF indicator indicating occurrence of the RLF for the secondary serving cell when the RLF for the secondary serving cell is detected;

269. Lin discloses [9.a] and [9b], which are substantially the same as [1.a]. *See* Section XI.B([1.a]).

[9.c] transmitting the RLF indicator to the master base station connected through radio resource control (RRC),

270. Lin discloses [9.c], which is substantially the same as [1.b]. *See* Section XI.B([1.b]).

[9.d] wherein the RLF indicator comprises a cell identifier (cell ID), and

271. Lin discloses [9.d], which is the same as [1.c]. *See* Section XI.B([1.c]).

[9.e] the user equipment stops uplink transmission of physical uplink shared channel (PUSCH), physical uplink control channel (PUCCH), and sounding reference signal (SRS) to the secondary serving cell, based on the RLF for the secondary serving cell.

272. Lin alone or in view of Pelletier suggests [9.e], which is the same as [1.d]. *See* Section XI.B([1.d]).

K. Dependent Claim 10

[10.P] The method of claim 9, further comprising:

273. Lin alone or in view of Pelletier suggests the apparatus of claim 9. I incorporate my discussion for claim 9.

[10.a] receiving an RRC connection reconfiguration message including secondary serving cell deconfiguration information for the secondary serving cell from the master base station; and
[10.b] deconfiguring the secondary serving cell at the user equipment side based on the secondary serving cell deconfiguration information.

274. Lin alone or in view of Pelletier renders obvious claim 10, which is substantially the same as claim 2. *See* Section XI.C.

L. Dependent Claim 11: *The method of claim 9, wherein the detection of the RLF for the secondary serving cell is performed based on radio link monitoring for the secondary serving cell.*

275. Lin alone or in view of Pelletier renders obvious claim 11, which is substantially the same as claim 4. *See* Section XI.E.

M. Dependent Claim 12

[12.P] The method of claim 11, further comprising:

276. Lin alone or in view of Pelletier suggests the apparatus of claim 11. I incorporate my discussion for claim 11.

[12.a] receiving a radio link monitoring set including radio link information for a primary serving cell provided by the master base station and radio link information for the secondary serving cell provided by the small base station from the master base station, [12.b] wherein the radio link monitoring for the secondary serving cell is performed based on the radio link monitoring set.

277. Lin alone or in view of Pelletier renders obvious claim 12, which is substantially the same as claim 3. *See* Section XI.D.

N. Dependent Claim 13: *The method of claim 9, wherein the detection of the RLF for the secondary serving cell is performed based on a radio link control protocol data unit (RLC PDU) retransmission count for the secondary serving cell.*

278. Lin alone or in view of Pelletier renders obvious claim 13, which is substantially the same as claim 5. *See* Section XI.F.

XII. Secondary Considerations

279. I have seen no evidence in the ’283 Patent’s prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus to any of the challenged claims. *See* generally EX1002. Indeed, per my discussion of the prior art referenced herein, any purported solutions to problems or unexpected results in the ’283 Patent were already well known. To the extent the Patent Owner

asserts the existence of any secondary considerations in its responses, I reserve my right to address any such evidence.

XIII. Additional Remarks

280. I currently hold the opinions expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

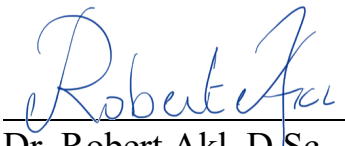
281. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination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

282. I have reviewed the accompanying Petition for *Inter Partes* Review of the ’283 Patent and, given the information set forth in this declaration, I agree with the reasoning and conclusions of the grounds of challenge in the petition. Based on my own analysis, I agree that: (1) Dudda anticipates or otherwise renders obvious claims 1-13, (2) Dudda in view of Pelletier also renders obvious claims 1-13, (3) Lin alone renders obvious claims 1-13, and (4) Lin in view of Pelletier also renders obvious claims 1-13.

* * *

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare 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 the Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this proceeding.

Dated: March 18, 2025

By: 

Dr. Robert Akl, D.Sc.
Dallas, Texas

APPENDIX A

Professor Robert Akl, D.Sc.

Professional Summary

Dr. Akl has over 30 years of industry and academic experience. He is currently a Tenured Professor at the University of North Texas and a Senior Member of IEEE. He has designed, implemented, and optimized both hardware and software aspects of several wireless communication systems for CDMA, Wi-Fi, and sensor networks. Dr. Akl has broad expertise in wireless communication, Bluetooth, CDMA/WCDMA network optimization, GSM, LTE, VoIP, telephony, computer architecture, and computer networks. He is a very active researcher and is well published and cited. He has been awarded many research grants by leading companies in the industry and the National Science Foundation. He has developed and taught over 100 courses in his field. Dr. Akl has received several awards and commendations for his work, including the 2008 IEEE Professionalism Award and was the winner of the 2010 Tech Titan of the Future Award.

Dr. Akl has extensive experience with patents in the wireless and networking industry. In the past ten years, he has worked as a technical expert in dozens of patent related matters, involving thousands of hours of research, investigation, and study. He has repeatedly been qualified as an expert by Courts, and has provided numerous technology tutorials to Courts, and given testimony by deposition and at trial. He has worked with companies large and small, both for and against the validity and infringement of patents, and has also helped counsel and Courts to understand technology that often seems complex. In doing so, he has become familiar with, and actively worked with, the legal principles that underlie patentability and validity and claim interpretation in the wireless and networking industries.

Areas of Expertise

2G, 3G, 4G, 5G, 6G, CDMA/WCDMA, GPS, GSM, UMTS, LTE, Ad-hoc Networks, Antenna Design, Bluetooth, Call Admission Control, Channel Coding, Channel Estimation, Communication Interfaces and Standards, Compression, Computer Architecture, Internet protocols, MIMO Systems, Multi-cell Network Optimization, Network Security, Packet-networks, Ring-networks, Switches and Routers, Telephony, VoIP, VPLS, Wi-Fi, Wireless Communication, Wireless Sensors.

Education

Year	College/University	Degree	GPA
2000	Washington University in Saint Louis	D.Sc. in Electrical Engineering	**4.0 / 4.0**
1996	Washington University in Saint Louis	M.Sc. in Electrical Engineering	**4.0 / 4.0**
1994	Washington University in Saint Louis	B.Sc. in Electrical Engineering	**4.0 / 4.0**
1994	Washington University in Saint Louis	B.Sc. in Computer Science	**4.0 / 4.0**

Graduated *summa cum laude* and ranked first in undergraduate class.

Dissertation: “Cell Design to Maximize Capacity in Cellular Code Division Multiple Access (CDMA) Networks.” Advisors: Dr. Manju Hegde and Dr. Paul Min.

Litigation Support and Expert Witness Experience

L1. 2025 **Bayes PLLC**
Case: OnePlus Technology (Shenzhen) Co. Ltd. v. Pantech Corporation IPR2025-00637
Matter: *Inter Partes* Review, radio link failure
Project: Declaration to support IPR Petition

L2. 2025 **Folio Law Group PLLP**
Case: K.Mizra LLC v. Ciena Corporation
Northern district of Georgia, Atlanta division, Case No. 1:24-cv-05442-SDG
Matter: Patent infringement, telecommunication systems, switches and routers
Project: Declaration in support of plaintiff’s amended complaint

L3. 2025 **Carter Arnett**
Case: Katana Silicon Technologies, LLC v. GlobalFoundries, Inc, et al.
Western district of Texas, Austin division, Case No. 1:22-cv-00852-RP
Matter: Patent infringement, telecommunication systems
Project: Declaration

L4. 2025 **Bunsow De Mory LLP**
Case: Secure Wi-Fi, LLC v. Samsung Electronics Co, LTD., Samsung Electronics America, Inc.
Eastern district of Texas, Marshall division, Case No. 2:24-cv-00047-JRG-RSP
Matter: Patent infringement, Wi-Fi access and security
Project: Declaration regarding claim construction

L5. 2024 **Steptoe LLP**
Case: Corrigent Corporation and Nahum Communication NTB LTD v. Dell Technologies Inc. and Dell Inc.; Corrigent Corporation and Nahum Communication NTB LTD v. Arista Networks Inc.
District of Delaware, Case No. 1:22-cv-496-RGA; Case No. 1:22-cv-497-RGA
Matter: Patent infringement, telecommunication systems, switches and routers
Project: Source code review, two expert reports regarding infringement, two rebuttal expert reports regarding validity, two reply expert reports, two supplemental rebuttal expert reports

L6. 2024 **Kilpatrick Townsend & Stockton LLP**
Case: Intellectual Ventures I LLC and Intellectual Ventures II LLC v. Lenovo Group Limited; Intellectual Ventures I LLC and Intellectual Ventures II LLC v. Zebra Technologies Corporation
Western district of Texas, Waco division, Case No. 6:23-cv-000307-ADA; Case No. 6:23-cv-00292-ADA
Matter: Patent infringement, cyclic diversity methods
Project: Source code review

L7. 2024 **Fish & Richardson, P.C.**
Case: Apple Inc. v. Apex Beam Technologies LLC
IPR2024-*To be Assigned*
Matter: *Inter Partes* Review, multi-antenna transmission
Project: Declaration to support IPR Petition

L8. 2024 **Perkins Coie LLP**
Case: ParkerVision, Inc. v. MediaTek Inc and MediaTek USA Inc.
Western district of Texas, Waco division, Case No. 6:22-cv-01163-ADA
Matter: Patent infringement, frequency translation
Project: Non-infringement consulting

L9. 2024 **Steptoe LLP**
Case: Stingray IP Solutions v. Leedarson IOT Technology, Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:23-cv-00499-JRG-RSP
Matter: Patent infringement, mobile ad-hoc networks
Project: Declaration regarding claim construction

L10. 2024 **Milbank LLP**
Case: Empire Technology Development LLC v. Samsung Electronics Co, LTD., Samsung Electronics America, Inc.
Eastern district of Texas, Marshall division, Case No. 2:23-cv-00427-JRG-RSP
Matter: Patent infringement, MIMO wireless communication, energy consumption
Project: Source code review, declaration regarding claim construction, expert report regarding infringement, expert report regarding validity, deposition

L11. 2024 **Folio Law Group PLLP**
Case: Valve Corporation v. Immersion Corporation
IPR2024-00477; IPR2024-00478; IPR2024-00557; IPR2024-00582; IPR2024-00714
Matter: *Inter Partes* Review, virtual reality and augmented reality
Project: Five declarations to support five Patent Owner's responses, deposition

L12. 2024 **Hicks Johnson PLLC**
Case: Cardtek International, Inc. v. The Kroger Co.
Eastern district of Texas, Marshall division, Case No. 2:23-cv-0045-JRG-RSP
Matter: Patent infringement, payment convergence system
Project: Expert report regarding infringement, rebuttal expert report regarding validity, deposition

L13. 2024 **Kilpatrick Townsend & Stockton LLP**
Case: PLR Worldwide Sales Limited v. Flip Phone Games Inc.
IPR2024-00132; IPR2024-00171; IPR2024-00200; IPR2024-00209; IPR2024-00133
Matter: *Inter Partes* Review, mobile gaming
Project: Four declarations to support four Patent Owner's responses, deposition

L14. 2024 **K & L Gates LLP**
Case: STA Group, LLC v. Motorola Solutions, Inc.
Eastern district of Texas, Marshall division, Case No. 2:23-cv-00300-JRG-RSP
Matter: Patent infringement, emergency communication networks
Project: Expert report regarding licenses, rebuttal expert report regarding validity, deposition

L15. 2024 **K & L Gates LLP**
Case: Motorola Solutions, Inc. v. STA Group, LLC
IPR2023-01292; IPR2023-01295 ; IPR2024-00511; IPR2024-00207
Matter: *Inter Partes* Review, emergency communication networks
Project: Four declarations to support four Patent Owner's responses

L16. 2024 **K & L Gates LLP**
Case: STA Group, LLC v. Motorola Solutions, Inc.
Eastern district of Texas, Marshall division, Case No. 2:22-cv-00381-JRG-RSP
Matter: Patent infringement, emergency communication networks
Project: Declaration regarding claim construction, deposition, expert report regarding infringement, rebuttal expert report regarding validity

L17. 2024 **White & Case, LLP**
Case: Wangs Alliance Corporation d/b/a WAC Lighting. v. Minka Lighting, LLC
In the Matter of Certain Smart Ceiling Fans, Components Thereof, and Associated Systems and Software Thereof, ITC Investigation No. 337-TA-1374
Matter: Patent infringement, smart ceiling fans

Project: Expert report regarding invalidity, expert rebuttal report, two-day depositions

L18. 2024 **Folio Law Group PLLP**
Case: Immersion Corporation v. Valve Corporation.
Western district of Washington, Seattle, Case No. 2:23-CV-00712-TL
Matter: Patent infringement, virtual reality and augmented reality
Project: Declaration regarding claim construction

L19. 2024 **Latham & Watkins LLP**
Case: AX Wireless LLC v. Dell Inc., et al.; AX Wireless LLC, v. HP Inc.
Eastern district of Texas, Marshall division, Case No. 2:22-cv-277-RWS-RSP; Case No. 2:22-cv-279-JRG-RSP
Matter: Patent infringement, Wi-Fi networks
Project: Source code review, expert report regarding infringement, rebuttal expert report regarding validity, deposition

L20. 2024 **Perkins Coie LLP**
Case: Wi-LAN Inc. et al. v. Huizhou TCL Mobile Communication Co. Ltd., et al.
Central district of California, Southern division, Case No. 8:19-cv-00870-JVS-ADS
Matter: Patent infringement, QoS enhancements for wireless IP networks
Project: Declaration regarding claim construction

L21. 2024 **Kilpatrick Townsend & Stockton LLP**
Case: Flip Phone Games Inc. v. PLR Worldwide Sales Limited
Eastern district of Texas, Marshall division, Case No. 2:23-cv-00139-JRG
Matter: Patent infringement, mobile gaming
Project: Declaration regarding claim construction, deposition

L22. 2024 **K & L Gates LLP**
Case: STA Group, LLC v. Motorola Solutions, Inc.
Eastern district of Texas, Marshall division, Case No. 2:22-cv-00381-JRG-RSP
Matter: Patent infringement, emergency communication networks
Project: Declaration regarding claim construction, deposition, expert report regarding infringement, rebuttal expert report regarding validity

L23. 2024 **Alston & Bird LLP**
Case: Stingray IP Solutions v. Snap One Holdings Corp., et al.
Eastern district of Texas, Marshall division, Case No. 2:23-cv-00003-JRG-RSP
Matter: Patent infringement, mobile ad-hoc networks
Project: Declaration regarding claim construction, deposition

L24. 2024 **Kilpatrick Townsend & Stockton LLP**
Case: Askeladden LLC v. Calabrese Stemer LLC
IPR2024-00367; IPR2024-00368; IPR2024-00369
Matter: *Inter Partes* Review, secure transactions and payments
Project: Declaration to support three IPR petitions

L25. 2023 **McGuireWoods LLP**
Case: VoIP-Pal.com, Inc. v. Huawei Technologies Co., Ltd., et al.
Northern district of Texas, Dallas division, Case No. 3:23-cv-0151-X
Matter: Patent infringement, call routing
Project: Declaration regarding 101 Motion

L26. 2023 **Steptoe LLP**
Case: Corrigent Corporation v. Cisco Systems, Inc.
Western district of Texas, Waco division, Case No. 6:22-cv-00396-ADA
Matter: Patent infringement, telecommunication systems, switches and routers
Project: Source code review, expert report regarding infringement, expert report regarding validity, two-day depositions, supplemental expert report, jury trial testimony

L27. 2023 **Latham & Watkins LLP**
Case: Netgear Inc. v. TP-Link Technologies Co., Ltd., TP-Link Corporation Limited, TP-Link USA Corporation, and TP-Link Research America Corp.
In the Matter of Certain Wi-Fi Routers, Wi-Fi Devices, Mesh Wi-Fi Network Devices, and Hardware and Software Components Thereof, ITC Investigation No. 337-TA-1361
Matter: Patent infringement, Wi-Fi and mesh networks
Project: Source code review, expert report regarding infringement and domestic industry, expert report regarding validity, supplemental expert report, deposition, ITC hearing testimony

L28. 2023 **Winston & Strawn LLP**
Case: Google, LLC. v. Flypsi, Inc.
IPR2023-00357; IPR2023-00358; IPR2023-00359;
IPR2023-00360; IPR2023-00361
Matter: *Inter Partes* Review, primary and secondary call processing
Project: Five declarations to support five Patent Owner's responses, deposition

L29. 2023 **Carter Arnett**
Case: Correct Transmission, LLC v. Nokia Corporation, et al.
Eastern district of Texas, Marshall division, Case No. 2:22-cv-00343-JRG-RSP
Matter: Patent infringement, telecommunication systems, switches and routers

Project: Declaration regarding claim construction

L30. 2023 **Carter Arnett**
Case: Smart Path Connections, LLC v. Nokia Corporation, et al.
Eastern district of Texas, Marshall division, Case No. 2:22-cv-00296-JRG
Matter: Patent infringement, network communication systems, switches and routers
Project: Two declarations regarding claim construction

L31. 2023 **Devlin Law Firm**
Case: Google, LLC. v. Motion Offense, LLC
IPR2022-01311; IPR2022-01312; IPR2022-01313
Matter: *Inter Partes* Review, cloud storage and file requests
Project: Three declarations to support three Patent Owner's responses, deposition

L32. 2023 **Carter Arnett**
Case: Cisco Systems, Inc. v. Zilkr Cloud Technologies, LLC
IPR2023-00553; IPR2023-00663; IPR2023-00822
Matter: *Inter Partes* Review, integration of communication services
Project: Two declarations to support two Patent Owner's preliminary responses

L33. 2023 **Friedman, Suder & Cooke; Kane Russell Coleman Logan PC**
Case: Q Technologies, Inc. v. Walmart Inc.
Western district of Texas, Waco division, Case No. 4W-21-CV-00321-ADA
Matter: Patent infringement, content sharing and payment systems
Project: Validity expert report, deposition

L34. 2023 **K & L Gates LLP**
Case: Entropic Communications, LLC v. DirectTV, LLC, Dish Network Corporation et al.
Central district of California, Southern division, Case No. 2:22-cv-07775-JWH-JEM, 2:22-cv-07959
Matter: Patent infringement, satellite and cable receivers and systems
Project: Declaration regarding claim construction, deposition, tech tutorial testimony

L35. 2023 **Folio Law Group PLLP**
Case: Immersion Corporation v. Meta Platforms, Inc., f/k/a Facebook, Inc.
Western district of Texas, Waco division, Case No. 6:22-cv-00541-ADA
Matter: Patent infringement, virtual reality and augmented reality

Project: Source code review, expert report regarding infringement, supplemental expert report regarding infringement, rebuttal expert report regarding validity, two depositions

L36. 2023 **Cole Schotz P.C.**
Case: SB IP Holdings, Inc. v. Vivint Smart Home, Inc., Vivint, Inc.
Eastern district of Texas, Sherman division, Case No. 4:20-cv-00886-ALM
Matter: Patent infringement, wireless telecommunication systems
Project: Source code review, expert report regarding infringement, expert report regarding validity, two-day depositions, rebuttal expert report regarding non-infringing alternatives, 2 additional depositions, jury trial testimony

L37. 2023 **Cole Schotz P.C.**
Case: Vivint Inc. v. SB IP Holdings LLC
IPR2022-00812; IPR2022-01449
Matter: *Inter Partes* Review, wireless telecommunication systems
Project: Two declarations to support Patent Owner's responses, deposition

L38. 2023 **Carter Arnett**
Case: Samsung Electronics Co., LTD v. G+ Communications, LLC
IPR2022-01598; IPR2023-00171; IPR2023-00665
Matter: *Inter Partes* Review, 4G/5G cellular systems
Project: Three declarations to support three Patent Owner's preliminary responses, two declarations to support Patent Owner's responses, two depositions

L39. 2023 **Fish & Richardson, P.C.**
Case: Neo Wireless, LLC v. General Motors Co. et al.;
Neo Wireless, LLC v. Tesla Inc.
Eastern district of Michigan, Southern division, Case No. 2:22-cv-11407-TGB; Case No. 2:22-cv-11408-TGB
Matter: Patent infringement, 4G/LTE wireless communication
Project: Tech tutorial testimony, declaration regarding claim construction

L40. 2023 **Carter Arnett**
Case: G+ Communications v. Samsung Electronics Co., LTD et al.
Eastern district of Texas, Marshall division, Case No. 2:22-cv-00078-JRG
Matter: Patent infringement, 4G/5G cellular systems
Project: Source code review, declaration regarding claim construction, supplemental declaration regarding claim construction, infringement expert report, rebuttal expert report regarding validity, deposition, two supplemental reports, second deposition, jury trial testimony, jury retrial testimony (for damages)

L41. 2022 **Kilpatrick Townsend & Stockton LLP**
Case: TP-Link Technologies Co., Ltd. and TP-Link Corporation Limited v. Stingray IP Solutions
IPR2022- *To be Assigned*; IPR2022-*To be Assigned*
Matter: *Inter Partes* Review, security and intrusion detection in wireless systems
Project: Two declarations to support two IPR petitions

L42. 2022 **Devlin Law Firm**
Case: CDN Innovations, LLC v. Mediacom Communication Corporation
Middle district of Georgia, Columbus division
Matter: Patent infringement, telecommunication systems
Project: Declaration to support infringement contentions

L43. 2022 **Jenner & Block LLP**
Case: WSOU Investments, LLC v. Netgear, Inc.
District of Delaware, Case No. 21-cv-01117-MN-CJB, 21-cv-01119-MN-CJB, 21-cv-01120-MN-CJB
Matter: Patent infringement, adaptive antennas, routers
Project: Declaration regarding claim construction

L44. 2022 **Simpson Thacher & Bartlett LLP**
Case: XR Communications, LLC. v. Ubiquiti Networks, Inc.
Central district of California, Case No. 2:21-cv-1065-DOC(JDE)
Matter: Patent infringement, Wi-Fi and adaptive antennas
Project: Non-infringement expert report, deposition

L45. 2022 **Ropes & Gray LLP**
Case: Speir Technologies Ltd. v. Apple Inc.
Western district of Texas, Waco division, Case No. 6:22-cv-00077-ADA
Matter: Patent infringement, channel estimation
Project: Declaration regarding claim construction

L46. 2022 **Fish & Richardson, P.C.**
Case: Constellation Designs, LLC v. LG Electronics, Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:21-cv-448
Matter: Patent infringement, channel coding
Project: Source code review, invalidity expert report, non-infringement expert report, two-day depositions, jury trial testimony

L47. 2022 **Calfee, Halter & Griswold LLP**
Case: Resi Media LLC v. BoxCast Inc.
IPR2022-00066; IPR2022-00067
Matter: *Inter Partes* Review, autonomous broadcasting

Project: Combined declaration to support Patent Owner's response, declaration to support Patent Owner's sur-reply, deposition

L48. 2022 **Fish & Richardson, P.C.**
Case: FedEx Corporation v. Transcend Shipping Systems, LLC
IPR2022-01117; IPR2022-01219; IPR2022-01252;
IPR2022-01261; IPR2022-01314
Matter: *Inter Partes* Review, location management
Project: Five declarations to support five IPR petitions

L49. 2022 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: Toyota Motor Corp and Continental Automotive Systems. v.
Intellectual Ventures II, LLC
IPR2022-00971; IPR2022-00972; IPR2022-00973; IPR2022-00974;
IPR2022-01130
Matter: *Inter Partes* Review, multicarrier communication
Project: Five declarations to support five IPR petitions, four depositions, three supplemental declarations, two depositions

L50. 2022 **Fenwick & West LLP**
Case: TrackThings LLC v. Amazon.com, Inc. et al.
Western district of Texas, Waco division, Case No. 6:21-cv-00720
Matter: Patent infringement, mobile ad-hoc networks
Project: Invalidity consulting

L51. 2022 **Fenwick & West LLP**
Case: Stingray IP Solutions v. Amazon.com, Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:21-cv-00193-JRG; Case No. 2:21-cv-00194-JRG
Matter: Patent infringement, mobile ad-hoc networks
Project: Noninfringement consulting

L52. 2022 **Fitch, Even, Tabin & Flannery**
Case: L2 Mobile Technologies LLC v. Ford Motor Company
District of Delaware, Case No. 1:21-cv-01409-JLH
Matter: Patent infringement, wireless communication systems
Project: Standard essentiality consulting

L53. 2022 **Susman Godfrey LLP**
Case: California Institute of Technology v. Samsung Electronics Co., Ltd. et al.
Eastern district of Texas, Marshall division, Case No. 2:21-cv-00446-JRG
Matter: Patent infringement, low-density parity-check codes
Project: Source code review, infringement expert report, deposition, supplemental infringement expert report

L54. 2022 **Devlin Law Firm**
Case: Dropbox, Inc. v. Motion Offense, LLC; Motion Offense, LLC v. Dropbox, Inc.
Western district of Texas, Waco division, Case No. 6:20-cv-00251-ADA; 6:21-cv-00758-ADA
Matter: Patent infringement, telecommunication systems and networking
Project: Source code review, infringement expert report, supplemental infringement expert report, validity expert report, supplemental validity expert report, deposition, jury trial testimony

L55. 2022 **Bayes PLLC**
Case: Guangdong OPPO Mobile Telecommunications Corp., Ltd. v. Nokia Solutions and Networks Oy
IPR2022-00632
Matter: *Inter Partes* Review, PDU and SDU
Project: Declaration to support IPR petition, deposition, supplemental declaration, second deposition

L56. 2022 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: NetApp, Inc. v. Proven Networks, LLC
IPR2022-00644
Matter: *Inter Partes* Review, allocating resources
Project: Declaration to support IPR petition

L57. 2022 **Devlin Law Firm**
Case: Motion Offense, LLC v. Google, LLC
Western district of Texas, Waco division, Case No. 6:21-cv-00514-ADA
Matter: Patent infringement, telecommunication systems and networking
Project: Declaration regarding claim construction

L58. 2022 **Jenner & Block LLP**
Case: Netgear, Inc. v. WSOU Investments, LLC
IPR2022-00516; IPR2022-00606
Matter: *Inter Partes* Review, telecommunication systems
Project: Two declarations to support two IPR petitions

L59. 2022 **Calfee, Halter & Griswold LLP**
Case: BoxCast Inc. v. Resi Media LLC
Eastern district of Texas, Marshall division, Case No. 2:21-cv-00217-JRG
Matter: Patent infringement, autonomous broadcasting
Project: Source code review, declaration regarding claim construction, declaration regarding validity, declaration regarding infringement, deposition

L60. 2022 **Fish & Richardson, P.C.**
Case: Apple Inc. v. Ericsson Inc.
IPR2022-00341; IPR2022-00346;
IPR2022-*To be assigned*; IPR2022-*To be assigned*;
IPR2022-*To be assigned*
Matter: *Inter Partes* Review, wireless communication systems
Project: Five declarations to support five IPR petitions, deposition

L61. 2022 **Ropes & Gray LLP**
Case: Godo Kaisha IP Bridge 1 v. Nokia Corporation, Ericsson Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:21-CV-213-JRG; Case No. 2:21-CV-215-JRG
Matter: Patent infringement, wireless communication systems
Project: Declaration regarding claim construction

L62. 2022 **Fish & Richardson, P.C.**
Case: Apple Inc. and HP Inc. v. XR Communication Inc
IPR2022-00367; IPR2022-01155; IPR2022-01362
Matter: *Inter Partes* Review, adaptive antennas
Project: Two declarations to support two IPR petitions, deposition, declaration to support petitioners' reply

L63. 2021 **Mayer Brown LLP**
Case: Pantech Corp. v. Coolpad Group Ltd.
Eastern district of Texas, Texarkana division, Case No. 5:21-cv00065
Matter: Patent infringement, LTE wireless communication systems
Project: Infringement consulting

L64. 2021 **Fitch, Even, Tabin & Flannery**
Case: L2 Mobile Technologies LLC v. Google LLC
Western district of Texas, Waco division, Case No. 6:21-cv-00358-ADA
Matter: Patent infringement, wireless communication systems
Project: Claim construction consulting

L65. 2021 **Morgan Lewis & Bockius LLP**
Case: Intellectual Tech LLC v. Zebra Technologies Corporation
Western district of Texas, Waco division, Case No. 6:19-cv-00628-ADA
Matter: Patent infringement, RFID tags
Project: Source code review, claim construction consulting, invalidity expert report

L66. 2021 **Carter Arnett**
Case: Correct Transmission LLC v. Adtran, Inc.
Northern district of Alabama, Northeastern division, Case No. 5:21-cv-00690-LCB
Matter: Patent infringement, telecommunication systems, switches and routers
Project: Declaration regarding claim construction

L67. 2021 **Carter Arnett**
Case: Juniper Networks, Inc. v. Correct Transmission, LLC
IPR2021-00463; IPR2021-00682; IPR2022-00815
Matter: *Inter Partes* Review, network communication systems, switches and routers
Project: Two declarations to support 2 Patent Owner's responses, two depositions; declaration to support Patent Owner's preliminary response

L68. 2021 **King & Wood Mallesons LLP**
Case: ToT Power Control, S.L. v. AT&T Mobility et al.; ToT Power Control, S.L. v. T-Mobile USA, Inc. et al.
Western district of Texas, Waco division, Case No. 6:21-CV-00107-ADA; 6:21-CV-00109-ADA
Matter: Patent infringement, WCDMA cellular systems
Project: Declaration regarding claim construction

L69. 2021 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: Xiaomi Communications Co., Ltd. v. Koninklijke KPN N.V.
IPR2022-00025
Matter: *Inter Partes* Review, network communication systems
Project: Declaration to support IPR petition

L70. 2021 **Carter Arnett**
Case: Juniper Networks, Inc. v. Smart Path Connections, LLC
IPR2021-001170; IPR2021-01356; IPR2022-00240; IPR2022-00815
Matter: *Inter Partes* Review, network communication systems, switches and routers
Project: Declaration to support Patent Owner's preliminary response, three declarations to support three Patent Owner's responses, two depositions

L71. 2021 **Devlin Law Firm**
Case: Dyfan LLC v. Target Corporation
District of Delaware, Case No. 6:19-cv-00179-ADA
Matter: Patent infringement, network communications
Project: Declaration to support summary judgement, deposition

L72. 2021 **Alston & Bird LLP**
Case: Stingray IP Solutions v. Signify N.V., et al.
Eastern district of Texas, Marshall division, Case No. 2:21-cv-00043-JRG; Case No. 2:21-cv-00044-JRG
Matter: Patent infringement, mobile ad-hoc networks
Project: Declaration regarding claim construction

L73. 2021 **Cole Schotz P.C.**
Case: SkyBell Technologies, Inc. v. Vivint Smart Home, Inc., SimpliSafe, Inc., and Arlo Technologies Inc
In the Matter of Certain IP Camera Systems Including Video Doorbells and Components Thereof, ITC Investigation No. 337-TA-1242
Matter: Patent infringement, wireless telecommunication systems
Project: Source code review, expert report infringement and domestic industry, rebuttal expert report, three-day depositions

L74. 2021 **Axinn, Veltrop & Harkrider LLP**
Case: Koninklijke Philips N.V. v. Thales DIS AIS USA, LLC et al.
In the Matter of Certain UMTS and LTE Cellular Communication Modules and Products Containing the Same, ITC Investigation No. 337-TA-1240
Matter: Patent infringement, wireless communication systems
Project: Expert report regarding non-infringement and no domestic industry, deposition, ITC hearing testimony

L75. 2021 **Morgan Lewis & Bockius LLP**
Case: SIPCO, LLC v. Aruba Networks, LLC and Hewlett Packard Enterprise Company
District of Delaware, Case No. 1:20-cv-00537-MN
Matter: Patent infringement, wireless communication systems
Project: Declaration regarding claim construction

L76. 2021 **Ropes & Gray LLP**
Case: Palo Alto Networks Inc. v. Centripetal Networks, Inc.
IPR2021-01150, IPR2021-01151, IPR2021-01155, IPR2021-01156, IPR2021-01270, PGR2021-00108, IPR2021-01520, IPR2021-01521
Matter: *Inter Partes* Review, network security systems
Project: Seven declarations to support seven IPR petitions, declaration to support post grant review, deposition

L77. 2021 **Devlin Law Firm**
Case: CDN Innovations, LLC v. Grande Communications Networks, LLC
Eastern district of Texas, Sherman division, Case No. 4:20-cv-653-SDJ
Matter: Patent infringement, telecommunication systems

Project: Declaration to support infringement contentions

L78. 2021 **Banner Witcoff**
Case: Sisvel International S.A., 3G Licensing S.A. v. ZTE (USA) Inc. et al.
Northern district of Texas, Case No. 3:20-cv-01289-M
Matter: Patent infringement, wireless communication systems
Project: Declaration regarding claim construction, deposition

L79. 2021 **Paul Hastings LLP**
Case: G. Holdings Ltd. v. Samsung Electronics Co., et al.
Eastern district of Texas, Marshall division, Case No. 2:20-cv-00342-JRG
Matter: Patent infringement, electronic payment systems
Project: Declaration regarding claim construction

L80. 2021 **Morgan Lewis & Bockius LLP**
Case: Aruba Networks, LLC and Hewlett Packard Enterprise Company v. SIPCO, LLC
IPR2021-00787
Matter: *Inter Partes* Review, wireless communication systems
Project: Declaration to support IPR petition

L81. 2021 **Jenner & Block LLP**
Case: Virentem Ventures LLC D/B/A Enounce v. TiVo Corp and Xperi Holding Corporation
District of Delaware, Case No. 20-787-MN
Matter: Patent infringement, telecommunication systems
Project: Declaration regarding claim construction

L82. 2021 **Carter Arnett**
Case: Correct Transmission LLC v. Adtran, Inc. and Juniper Networks, Inc.
Western district of Texas, Waco division, Case No. 6:20-cv-669-ADA
Matter: Patent infringement, telecommunication systems
Project: Source code review, declaration regarding claim construction

L83. 2021 **Fish & Richardson, P.C.**
Case: Quectel Wireless Solutions Co. Ltd. v. Koninklijke Philips N.V.
IPR2021-00558, IPR2021-00559, IPR2021-00561
Matter: *Inter Partes* Review, wireless communication systems
Project: Three declarations to support three IPR petitions, declaration to support reply, two depositions

L84. 2021 **Goldberg Kohn Ltd**
Case: United States ex. rel. Todd Heath v. Wisconsin Bell, Inc
District of Columbia, Case No. 11-cv-01897
Matter: Networking systems

Project: Technology consulting

L85. 2021 **Fish & Richardson, P.C.**
Case: Samsung Electronics Co. Ltd. v. Ericsson Inc.
IPR2021-00447, IPR2021-00588, IPR2021-00613, IPR2021-00614, IPR2021-00643, IPR2021-00645, IPR2021-00684
Matter: *Inter Partes* Review, wireless communication systems
Project: Seven declarations to support seven IPR petitions

L86. 2020 **Kilpatrick Townsend & Stockton LLP**
Case: GREE Inc. v. Supercell Oy
Eastern district of Texas, Marshall division, Case No. 2:19-cv-00413-JRG-RSP
Matter: Patent infringement, mobile gaming
Project: Source code review, infringement expert report, supplemental expert report, validity expert report, deposition

L87. 2020 **Banner Witcoff**
Case: Sisvel International S.A., 3G Licensing S.A. v. ZTE (USA) Inc. et al.
Northern district of Texas, Case No. 3:19-cv-01694-N
Matter: Patent infringement, wireless communication systems
Project: Declaration regarding claim construction, deposition

L88. 2020 **Fish & Richardson, P.C.**
Case: Cellco Partnership D/B/A Verizon Wireless v. Huawei Technologies Co., Ltd
IPR2020-01352, IPR202-01356, IPR2020-01357
Matter: *Inter Partes* Review, network communication systems
Project: Three declarations to support 3 Patent Owner' responses

L89. 2020 **Kilpatrick Townsend & Stockton LLP**
Case: GREE Inc. v. Supercell Oy
Eastern district of Texas, Marshall division, Case No. 2:20-cv-00113-JRG-RSP
Matter: Patent infringement, mobile gaming
Project: Source code review, declaration supporting claim construction, infringement expert report, validity expert report, supplemental report, deposition

L90. 2020 **Kilpatrick Townsend & Stockton LLP**
Case: GREE Inc. v. Supercell Oy
Eastern district of Texas, Marshall division, Case No. 2:19-cv-00200-JRG-RSP, Case No. 2:19-cv-00237-JRG-RSP, Case No. 2:19-cv-00310-JRG-RSP; Case No. 2:19-cv-00311-JRG-RSP
Matter: Patent infringement, mobile gaming

Project: Source code review, four infringement expert reports, two supplemental infringement expert reports, four validity expert reports, two supplemental expert reports, two second supplemental expert reports, three-day depositions, jury trial testimony

L91. 2020 **Sheridan Ross P.C.**
Case: Justservice.net LLC v. Dropbox, Inc.
Western district of Texas, Waco division, Case No. 6:20-CV-00070-ADA
Matter: Patent infringement, computer systems and networking
Project: Source code review, declaration regarding claim construction

L92. 2020 **Perkins Coie LLP**
Case: Huizhou TCL Mobile Communication Co. Ltd., TCT Mobile (US) Inc., and TCL Mobile Communication (HK) Co., Ltd. v. Wi-LAN Inc.
Matter: *Ex Partes* Reexamination, QoS enhancements for wireless IP networks
Project: Declaration to support Requesters

L93. 2020 **Perkins Coie LLP**
Case: Intel Corporation v. UNM Rainforest Innovations
IPR2020-01576, IPR2020-01578, IPR2020-*to be assigned*
Matter: *Inter Partes* Review, wireless broadband
Project: Three declarations to support three IPR petitions

L94. 2020 **Calfee, Halter & Griswold LLP**
Case: Motorola Solutions, Inc. v. Hytera Communications Corp. Ltd. et al.
Northern district of Illinois, Case No. 1:17-cv-01972
Matter: Patent infringement, two-way radios
Project: Declaration regarding claim construction, deposition, expert report regarding invalidity, rebuttal expert report regarding non-infringement, three-day depositions

L95. 2020 **Fish & Richardson, P.C.**
Case: Huawei Technologies Co., Ltd et al. v. Verizon Communications, Inc. et al.
Western district of Texas, Waco division, Case No. 6-20-cv-00090
Matter: Patent infringement, video communication
Project: Source code review, declaration regarding claim construction, infringement expert report, validity expert report, deposition

L96. 2020 **Kilpatrick Townsend & Stockton LLP**
Case: GREE Inc. v. Supercell Oy
Eastern district of Texas, Marshall division, Case No. 2:19-cv-00070-JRG-RSP, Case No. 2:19-cv-00071-JRG-RSP
Matter: Patent infringement, mobile gaming

Project: Source code review, two infringement expert reports, two supplemental infringement expert reports, two second supplemental infringement expert reports, two rebuttal expert reports on validity, two-day depositions, seven declarations supporting Gree's opposition to Supercell's motions for summary judgement, jury trial testimony

L97. 2020 **Cooley LLP**
Case: Saint Lawrence Communications, LLC v. Amazon.com, Inc., et al.
Eastern district of Texas, Marshall division, Case No. 2:19-cv-00027-JRG
Matter: Patent infringement, AMR-WB, speech compression, coding and decoding
Project: Invalidity expert report

L98. 2020 **Prince Lobel Tye LLP**
Case: Intellectual Ventures I and II LLC v. VMware, Inc.
Western district of Texas, Austin division, Case No. 1:19-cv-01075-ADA
Matter: Patent infringement, networking systems
Project: Declaration regarding claim construction

L99. 2020 **Gibson, Dun & Crutcher LLP**
Case: Cellular Evolution LLC v. T-Mobile US, Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:19-cv-232-JRG
Matter: Patent infringement, cellular systems
Project: Invalidity consulting

L100. 2020 **Faegre Baker Daniels LLP**
Case: CommScope, Inc. v. Rosenberger Technology, et al.
District of New Jersey, Case No. 19-cv-15962-MCA-LDW
Matter: Trade secret software, base station antenna design
Project: Declaration, deposition

L101. 2020 **Ropes & Gray LLP**
Case: Canon, Inc. v. TCL Electronics Holdings Ltd., et al.
Eastern district of Texas, Marshall division, Case No. 2:18-cv-546-JRG
Matter: Patent infringement, communication interfaces
Project: Source code review, declaration regarding claim construction, deposition

L102. 2019 **Perkins Coie LLP**
Case: Huizhou TCL Mobile Communication Co. Ltd., TCT Mobile (US) Inc., and TCL Mobile Communication (HK) Co., Ltd. v. Wi-LAN Inc.
IPR2020-00302, IPR2020-00303
Matter: *Inter Partes* Review, QoS enhancements for wireless IP networks

Project: Two declarations to support two IPR petitions

L103. 2019 **Fish & Richardson**
Case: Bell Northern Research v. Huawei, et al.
Southern district of California, Case No. 3:18-cv-1784-CAB-BLM
Matter: Patent infringement, wireless networks
Project: Invalidity consulting

L104. 2019 **K & L Gates LLP**
Case: EVS CODEC Technologies, LLC and Saint Lawrence Communications, LLC v. ZTE Corporation, et al.
Northern district of Texas, Dallas division, Case No. 3:19-cv-00385-MBH
Matter: Patent infringement, EVS, speech compression, coding and decoding
Project: Invalidity expert report

L105. 2019 **Feinberg Day Alberti Lim & Belloli LLP**
Case: Uniloc 2017 LLC v. AT&T Mobility LLC, et al.
Eastern district of Texas, Marshall division, Case No. 2:18-cv-00514-JRG
Matter: Patent infringement, wireless frequency bands and devices
Project: Two declarations regarding claim construction, deposition

L106. 2019 **Susman Godfrey LLP**
Case: Sol IP, LLC v. AT&T Mobility LLC, et al.
Eastern district of Texas, Marshall division, Case No. 2:18-cv-00526; 2:18- cv-00527; and 2:18-cv-00528
Matter: Patent infringement, Wi-Fi and LTE
Project: Validity consulting

L107. 2019 **Ropes & Gray LLP**
Case: Huawei Technologies Co. Ltd. v. Harris Global Communications, Inc.
IPR2019-01512, IPR2019-01631
Matter: *Inter Partes* Review, routing and security in wireless networks
Project: Two declarations to support two IPR petitions

L108. 2019 **Ropes & Gray LLP**
Case: Harris Corporation v. Huawei Device USA, Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:18-cv-00439-JRG
Matter: Patent infringement, routing and security in wireless networks
Project: Declaration regarding claim construction

L109. 2019 **Erise IP**
Case: Semcon IP Inc. v. ASUSTeK Computer Inc.
Eastern district of Texas, Marshall division, Case No. 2:18-cv-00193-JRG
Matter: Patent infringement, adaptive power control
Project: Non-infringement expert report

L110. 2019 **Cooley LLP**
Case: Facebook Inc. v. BlackBerry Corp. et al.
Northern District of California, Oakland division, Case No. 4:18-cv-05434-JSW
Matter: Patent infringement, mobile computing
Project: Declaration regarding claim construction

L111. 2019 **Sidley Austin LLP**
Case: Semcon IP Inc. v. Amazon.com, Inc.
Eastern district of Texas, Marshall division, Case No. 2:18-cv-00192-JRG
Matter: Patent infringement, adaptive power control
Project: Expert report regarding patent marking, rebuttal report regarding patent marking, deposition

L112. 2019 **Oblon, McClelland, Maier & Neustadt, LLP**
Case: MV3 Partners LLC v. Roku, Inc.
Western district of Texas, Waco division, Case No. 6:18-cv-308-ADA
Matter: Patent infringement, mobile set top box
Project: Declaration regarding claim construction, deposition, Markman hearing and tech tutorial testimony

L113. 2019 **Banner & Witcoff, LTD.**
Case: Kathrein USA, Inc. v. Fractus S.A.
IPR2019-00954, IPR2019-00955, IPR2019-00956, IPR2019-00957
Matter: *Inter Partes* Review, multiband antenna arrays
Project: Four declarations to support four IPR petitions

L114. 2019 **Fish & Richardson, P.C.**
Case: LG Electronics Inc. v. Saint Lawrence Communications LLC
Southern district of New York, Case No. 1:18-cv-11082-DLC
Matter: Patent infringement, EVS, speech compression, coding and decoding
Project: Declaration relating to motion for summary judgment, expert report, deposition

L115. 2019 **Ropes & Gray LLP**
Case: SIPCO, LLC v. Emerson Electric Co.
In the Matter of Certain Wireless Mesh Networking Products and Related Components Thereof, ITC Investigation No. 337-TA-1131
Matter: Patent infringement, links in wireless networks and remote monitoring
Project: Source code review, declaration regarding claim construction, invalidity expert report, rebuttal expert report regarding non-infringement and no domestic industry

L116. 2019 **Fish & Richardson, P.C.**
Case: Maxell Ltd. v. Huawei Technologies Co. Ltd., ZTE, et al.
Eastern district of Texas, Texarkana division, Case No. 5:18-cv-0033-RWS
Matter: Patent infringement, portable computing devices
Project: Declaration regarding claim construction

L117. 2019 **Ropes & Gray LLP**
Case: Emerson Electric Co. v. SIPCO, LLC
IPR2019-00548, IPR2019-00549
Matter: *Inter Partes* Review, routing in wireless networks
Project: Two declarations to support two IPR petitions

L118. 2018 **Mishcon de Reya New York LLP; King & Wood Mallesons LLP**
Case: ChanBond, LLC v. Cox Communications, Inc.
District of Delaware, Case No. 1:15-cv-00849-RGA
Matter: Patent infringement, wideband signal distribution system
Project: Validity expert report, deposition, sur-reply expert report, second sur-reply expert report, second deposition, jury trial with settlement mid-trial

L119. 2018 **Fish & Richardson, P.C.**
Case: In re: Qualcomm Antitrust Litigation (Client: Apple)
Southern district of California, Case No. 3:17-cv-00108-GPC-MDD
Matter: Qualcomm antitrust litigation
Project: Two expert rebuttal reports, deposition

L120. 2018 **Susman Godfrey LLP**
Case: In re: Qualcomm Antitrust Litigation (Client: Class Action)
Northern district of California, Case No. 5:17-md-02773-LHK
Matter: Qualcomm antitrust litigation
Project: Expert declaration on standard essential patents, expert report on deemed essential patents, rebuttal expert report, deposition

L121. 2018 **284 Partners**
Case: Federal Trade Commission. v. Qualcomm Incorporated
Northern district of California, Case No. 5:17-cv-00220
Matter: Qualcomm antitrust litigation
Project: Expert report on standard essential patents, expert rebuttal report, deposition

L122. 2018 **Vorys, Sater, Seymour and Pease LLP**
Case: Route1 Inc. v. Airwatch LLC
District of Delaware, Case No. 17-331-RGA
Matter: Patent infringement, remote access
Project: Source code review, declaration regarding claim construction, infringement expert report, validity expert report, reply expert report, deposition, three declarations regarding re-exam

L123. 2018 **Sidley Austin LLP**
Case: Samsung Electronics Co., Ltd v. Huawei Technologies Co., Ltd.
IPR2017-01471, IPR2017-01474, IPR2017-01475
Matter: *Inter Partes* Review, 4G/LTE
Project: Three declarations to support three Patent Owner's responses, supplemental declaration, deposition

L124. 2018 **Fitzpatrick Cella Harper & Scinto**
Case: IPC Systems, Inc. v. Cloud9 Technologies, LLC
District of Delaware, Case No. 16-cv-443-GMS
Matter: Patent infringement, telephone stations and trading turrets
Project: Source code review, declaration regarding claim construction, supplemental declaration regarding claim construction

L125. 2018 **Haynes and Boone, LLP**
Case: LG Electronics Inc., et al. v. Wi-LAN Inc., et al.
IPR2018-00673, IPR2018-00674, IPR2018-00704, IPR2018-00705, IPR2018-00709, IPR2018-00710
Matter: *Inter Partes* Review, bandwidth allocation
Project: Six declarations to support six IPR petitions, two depositions, two reply declarations

L126. 2018 **Pillsbury Winthrop Shaw Pittman LLP**
Case: Cellular Communications Equipment v. ZTE, HTC Corporation, et al.
Eastern district of Texas, Case No. 6:16-cv-475-RWS
Matter: Patent infringement, LTE, power control, emergency notification
Project: Invalidity expert report, deposition

L127. 2018 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: FanDuel, Inc. DraftKings, Inc., and Bwin.Party Digital Entertainment PLC. v. CG Technology Development, LLC
IPR2017-00902, IPR2017-01333, IPR2017-01491, IPR2017-01532
Matter: *Inter Partes* Review, location-based gaming
Project: Four declarations to support four Patent Owner's responses, two supplemental declarations, four depositions

L128. 2018 **Calfee, Halter & Griswold LLP**
Case: Hytera Communications Corp. Ltd. v. Motorola Solutions, Inc.
Northern district of Ohio, Case No. 1:17-cv-01794-DNC
Matter: Patent infringement, two-way radios
Project: Source code review, declaration regarding claim construction, rebuttal declaration regarding claim construction, deposition, infringement expert report, validity expert report, two-day depositions

L129. 2017 **Covington & Burling LLP**
Case: Sharp Corporation, et al. v. Hisense Co., Ltd., et al.
In the Matter of Certain Wi-Fi Enabled Electronic Devices and Components Thereof, ITC Investigation No. 337-TA-1072
Matter: Patent infringement, Wi-Fi, OFDMA
Project: Declaration regarding claim construction

L130. 2017 **Vorys, Sater, Seymour and Pease LLP**
Case: Airwatch LLC and VMWare Inc. v. Route1 Inc.
IPR2017-02145
Matter: *Inter Partes* Review, remote access
Project: Declaration to support Patent Owner's response

L131. 2017 **Arnold & Porter Kaye Scholer**
Case: Uniloc USA, Inc. v. Google, Inc.
Eastern district of Texas, Marshall division, Case No. 2:17-cv-0214-JRG, 2:17-cv-0224-JRG, 2:17-cv-0231-JRG, 2:17-cv-0465-JRG, 2:17-cv-0466-JRG, 2:17-cv-0467JRG
Matter: Patent infringement, VoIP messaging
Project: Invalidity consulting

L132. 2017 **Simpson Thacher & Bartlett LLP**
Case: XR Communications, LLC. v. Ubiquiti Networks, Inc.
Central district of California, Case No. 2:17-cv-02968-AG(JCGx)
Matter: Patent infringement, Wi-Fi and adaptive antennas
Project: Declaration regarding claim construction, deposition

L133. 2017 **Covington & Burling LLP**
Case: Huawei Device USA Inc. v. Hitachi Maxell, Ltd.
IPR2018-00209, IPR2018-00210
Matter: *Inter Partes* Review, base station selection, GPS/Cellular location
Project: Two declarations to support two IPR petitions

L134. 2017 **Calfee, Halter & Griswold LLP**
Case: Hytera Communications Corp. Ltd. v. Motorola Solutions, Inc.
IPR2018-00128, IPR2017-02183
Matter: *Inter Partes* Review, two-way radios
Project: Declaration to support IPR petition, deposition, two supplemental declarations, two depositions

L135. 2017 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: Hytera Communications Corp. Ltd. v. Motorola Solutions, Inc.
IPR2017-02179, IPR2017-02183
Matter: *Inter Partes* Review, two-way radios
Project: Two declarations to support two IPR petitions, deposition

L136. 2017 **Mayer Brown LLP**
Case: Silver Spring Networks, Inc. v. Sunrise Technologies, Inc.
Silver Spring Networks, Inc. v. Weatherproof Wireless, LLC
IPR2017-*To Be Assigned*, IPR2017-*To Be Assigned*
Matter: *Inter Partes* Review, power meter
Project: Two declarations to support two IPR petitions

L137. 2017 **Covington & Burling LLP**
Case: Hitachi Maxell, Ltd. v. Huawei Device USA Inc. et al.
Eastern district of Texas, Texarkana division, Case No. 5:16-cv-00178-RWS
Matter: Patent infringement, 3G/4G
Project: Source code review, declaration regarding claim construction, invalidity expert report, non-infringement expert report, non-infringing alternatives expert report, two depositions

L138. 2017 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: LG Electronics, Inc. et al. v. BLU Products, Inc. and CT Miami, LLC
In the Matter of Certain LTE Wireless Communication Devices and Components Thereof, ITC Investigation No. 337-TA-1051
Matter: Patent infringement, 4G/LTE
Project: Declaration regarding claim construction, second declaration regarding claim construction

L139. 2017 **Sidley Austin LLP**
Case: Huawei Technologies Co., Ltd. v. Samsung Electronics Co., Ltd.
IPR2017-01979, IPR2017-01980, IPR2017-01986
Matter: *Inter Partes* Review, 4G/LTE
Project: Three declarations to support three IPR petitions, deposition

L140. 2017 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: Motorola Solutions, Inc. v. Hytera Communications Corp. Ltd. et al.
In the Matter of Certain Two-way Radio Equipment Systems, Related Software and Components Thereof, ITC Investigation No. 337-TA-1053
Matter: Patent infringement, two-way radio
Project: Source code review, declaration regarding claim construction, invalidity expert report, non-infringement expert report, deposition, ITC hearing testimony

L141. 2017 **Haynes and Boone, LLP**
Case: Rackspace US, Inc. v. Realtime Data LLC
IPR2017-01691
Matter: *Inter Partes* Review, data compression
Project: Declaration to support IPR petition

L142. 2017 **Pillsbury Winthrop Shaw Pittman LLP**
Case: ZTE (USA), HTC Corporation, et al. v. Cellular Communications Equipment
IPR2017-01508, IPR2017-01509
Matter: *Inter Partes* Review, LTE, power control, emergency notification
Project: Two declarations to support two IPR petitions, two depositions

L143. 2017 **Alston & Bird LLP; Womble Carlyle Sandridge & Rice LLP**
Case: Itron, Inc. and Duke Energy Corp. v. Smart Meter Technologies
IPR2017-01199
Matter: *Inter Partes* Review, power meter
Project: Declaration to support IPR petition, deposition

L144. 2017 **Haynes and Boone, LLP**
Case: Ericsson Inc. v. Regents of the University of Minnesota
IPR2017-01186, IPR2017-01200, IPR2017-01213
Matter: *Inter Partes* Review, OFDM and MIMO
Project: Three declarations to support three IPR petitions

L145. 2017 **Quinn Emanuel Urquhart & Sullivan, LLP**
Case: GENBAND US, LLC v. Metaswitch Networks Ltd, et al.
Eastern district of Texas, Marshall division, Case No. 2:16-cv-582-JRG-RSP
Matter: Patent infringement, Internet protocols and VoIP, switches and routers

Project: Expert report regarding essentiality

L146. 2017 **Mayer Brown LLP**
Case: Uniloc USA, Inc. et al. v. Avaya Inc., ShoreTel, Inc., et al.
Eastern district of Texas, Tyler division, Case Nos. 6:15-cv-1168-JRG
Matter: Patent infringement, instant messaging and conference calling
Project: Source code review, non-infringement consulting

L147. 2017 **Fish & Richardson P.C.**
Case: Nokia Solutions and Networks US LLC, et al. v. Huawei Technologies Co. Ltd., et al.
Eastern district of Texas, Marshall division, Case Nos. 2:16-cv-753-JRG-RSP, 2:16-cv-754
Matter: Patent infringement, 4G/LTE
Project: Claim construction, two declarations

L148. 2017 **Rothwell Figg Ernst & Manbeck, PC; Pepper Hamilton LLP**
Case: Samsung Electronics, et al. v. Rembrandt Wireless Technologies, LP
IPR2015-00555
Matter: *Ex Parte* Reexamination, Bluetooth
Project: Two declarations to support two Patent Owner's responses, supplemental declaration to support Patent Owner's reply

L149. 2016 **Sidley Austin LLP**
Case: Huawei Technologies Co., et al. v. Samsung Electronics Co, et al. and Samsung Research America v. Hisilicon Technologies Co, LTD
Northern district of California, San Francisco division, Case No. 3:16-cv-2787-WHO
Matter: Patent infringement, 3G/4G/LTE
Project: Source code review, declaration regarding claim construction, declaration opposing summary judgement, infringement expert report, invalidity expert report, non-infringement expert report, validity expert report, two depositions

L150. 2016 **Bragalone Conroy PC**
Case: Securus Technologies, Inc. v. Global Tel*Link Corporation
CBM2017-00034
Matter: Covered Business Method Review, call monitoring and recording
Project: Declaration to support CBM petition, deposition

L151. 2016 **Braxton, Hilton & Perrone PLLC**
Case: Biosonix, LLC. v. Hydrowave, LLC et al.
Eastern district of Texas, Case No. 2:16-cv-139-RC
Matter: Patent infringement, underwater transceivers
Project: Claim construction, Markman hearing and tech tutorial testimony

L152. 2016 **Gray Reed & McGraw**
Case: Optis Cellular Technology, LLC and PanOptis Patent Management, LLC. v. Blackberry Corporation, et al.
Eastern district of Texas, Marshall division, Case No. 2:16-cv-59-JRG-RSP, Case No. 2:16-cv-61-JRG-RSP, Case No. 2:16-cv-62-JRG-RSP
Matter: Patent infringement, LTE
Project: Claim construction, three declarations regarding claim construction, deposition

L153. 2016 **Ropes & Gray LLP; Davidson Berquist Jackson & Gowdey**
Case: SIPCO, LLC et al v. Emerson Electric Co. et al
Eastern district of Texas, Tyler division, Case No. 6:15-cv-907
Emerson Electric Co. et al v. SIPCO, LLC et al.
Northern district of Georgia, Atlanta division, Case No. 1:15-cv-00319-AT
Matter: Patent infringement, links in wireless networks and remote monitoring
Project: Source code review, invalidity consulting

L154. 2016 **McKool Smith**
Case: Regents of University of Minnesota v. AT&T Mobility LLC, et al.
District of Minnesota, Case No. 0:14-cv-04666-JRT-TNL
Matter: Patent infringement, LTE and MIMO
Project: Invalidity consulting

L155. 2016 **EIP US LLP**
Case: GENBAND US, LLC et al. v. Metaswitch Networks Ltd
IPR2015-01456, IPR2015-01457
Matter: *Inter Partes* Review, media gateways, switches and routers
Project: Two declarations to support Patent Owner's responses, two depositions

L156. 2016 **Haynes and Boone, LLP**
Case: Cox Communications, Inc. v. AT&T Intellectual Property I, II, LP
IPR2015-01187, IPR2015-01227, IPR2015-01273, IPR2015-01536
Matter: *Inter Partes* Review, cable networks
Project: Four declarations to support Patent Owner's responses, four depositions

L157. 2016 **Mayer Brown LLP**
Case: Odyssey Wireless v. Motorola Mobility LLC
Eastern district of North Carolina, Western division, Case No. 5:14-cv-491-D
Southern district of California, Case No. 3:15-cv-01741-H-RBB
Matter: Patent infringement, LTE
Project: Source code review, non-infringement consulting

L158. 2016 **Cooley LLP; Finnegan LLP**
Case: Saint Lawrence Comm. LLC v. Motorola Mobility LLC, ZTE (USA) Inc., et al.
Eastern district of Texas, Marshall division, Case No. 2:15-cv-000351-JRG, Case No. 2:15-cv-000349-JRG
Matter: Patent infringement, speech compression, coding and decoding
Project: Invalidity expert report, expert report regarding AMR-WB standard, expert report regarding Opus and Silk, supplemental expert report regarding invalidity, two-day depositions, jury trial testimony for Motorola

L159. 2015 **Sidley Austin LLP**
Case: Evolved Wireless, LLC v. Microsoft Corp, et al.
District of Delaware, Case No. 15-cv-546
Matter: Patent infringement, LTE
Project: Prior art and invalidity consulting

L160. 2015 **McKool Smith**
Case: Optis Wireless Technology, LLC and PanOptis Patent Management, LLC. v. ZTE Corporation and ZTE (USA) Inc.
Eastern district of Texas, Marshall division, Case No. 2:15-cv-300-JRG-RSP
Matter: Patent infringement, cellular messages and multimedia attachments
Project: Source code review, claim construction, declaration

L161. 2015 **Fish & Richardson, P.C.**
Case: Saint Lawrence Comm. LLC v. LG Elec., Inc. et al.
Eastern district of Texas, Marshall division, Case No. 2:14-cv-1055-JRG
Matter: Patent infringement, speech compression, coding and decoding
Project: Invalidity expert report

L162. 2015 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: LG Electronics, Inc. v. Cellular Communications Equipment LLC
IPR2016-00178
Matter: *Inter Partes* Review, LTE
Project: Declaration to support IPR petition

L163. 2015 **McKool Smith**
Case: AT&T, et al. v. Cox Communication, Inc., et al.
District of Delaware, Case No. 14-1106-GMS
Matter: Patent infringement, cable networks
Project: Claim construction, declaration

L164. 2015 **McKool Smith**
Case: Ericsson Inc., et al. v. TCL Communication, et al.
Eastern district of Texas, Marshall division, Case No. 2:15-cv-00011-RSP
Matter: Patent infringement, wireless devices and systems
Project: Source code review, claim construction, declaration, infringement expert report, validity expert report, two-day depositions

L165. 2015 **Foley & Lardner LLP**
Case: Kyocera Communications, Inc. v. Cellular Communications Equipment LLC
IPR2015-01559, IPR2015-01564
Matter: *Inter Partes* Review, LTE, power control, emergency notification
Project: Two declarations to support two IPR petitions

L166. 2015 **Fish & Richardson, P.C.**
Case: Fairfield Industries Inc. v. Wireless Seismic, Inc.
Southern district of Texas, Case No. 4:14-cv-02972-KPE
Matter: Patent infringement, wireless sensor networks
Project: Non-infringement expert report

L167. 2015 **Quinn Emanuel Urquhart & Sullivan, LLP**
Case: GENBAND US, LLC v. Metaswitch Networks Ltd, et al.
Eastern district of Texas, Marshall division, Case No. 2:14-cv-33-JRG-RSP
Matter: Patent infringement, Internet protocols and VoIP, switches and routers
Project: Expert report regarding essentiality, non-infringement expert report, rebuttal expert report regarding non-practice, supplemental rebuttal expert report, three-day depositions, jury trial testimony

L168. 2015 **Duane Morris LLP; Foley & Lardner LLP**
Case: Mobile Telecommunications Technologies, LLC v. Leap Wireless International, Cricket Communications, Inc.
Eastern district of Texas, Marshall division, Case No. 2:13-cv-00885-RSP
Matter: Patent infringement, OFDM and MIMO
Project: Non-infringement expert report, deposition

L169. 2015 **Hogan Lovells US LLP; Kenyon & Kenyon LLP**
Case: One-E-Way v. Beats Electronics, LLC, Sony Corporation, et al.
In the Matter of Certain Wireless Headsets, ITC Investigation No. 337-TA-943
Matter: Patent infringement, wireless communication
Project: Claim construction, declaration

L170. 2015 **McKool Smith**
Case: Solocron Media, LLC v. AT&T Inc., et al.
Eastern district of Texas, Marshall division, Case No. 2:13-cv-1059-JRG
Matter: Patent infringement, ringtone download
Project: Claim construction, invalidity expert report

L171. 2015 **EIP US LLP**
Case: Good Technology Software, Inc. v. Mobile Iron, Inc.
IPR2015-00833, IPR2015-00836, IPR2015-01090
Matter: *Inter Partes* Review, software management in wireless devices
Project: Three declarations to support three IPR petitions

L172. 2015 **McKool Smith**
Case: AirWatch LLC v. Good Technology Corp
Northern district of Georgia, Case No. 1:14-cv-02281-SCJ
Matter: Patent infringement, software management in wireless devices
Project: Claim construction, declaration

L173. 2015 **Simpson Thacher & Bartlett LLP**
Case: IXI Mobile (R&D) Ltd. et al. v. Apple Inc.
Southern district of New York, Case No. 14-cv-7594-RJS
Matter: Patent infringement, PDA and Bluetooth
Project: Invalidity consulting

L174. 2014 **Bragalone Conroy PC**
Case: Global Tel*Link Corporation v. Securus Technologies, Inc.
IPR2014-00785, IPR2014-00810, IPR2014-00824, IPR2014-00825, IPR2014-01278, IPR2014-01282, IPR2014-01283
Matter: *Inter Partes* Review, VoIP call monitoring and recording, allocating telecommunication resources and information systems
Project: Seven declarations to support seven Patent Owner's responses, five depositions

L175. 2014 **Orrick, Herrington & Sutcliffe LLP**
Case: Shopkick, Inc. v. Novitaz, Inc.
IPR2015-00277, IPR2015-00278
Matter: *Inter Partes* Review, wireless customer service management
Project: Two declarations to support two IPR petitions

L176. 2014 **Paul Hastings LLP**
Case: Cellular Communications Equipment LLC v. AT&T, et al.
Eastern district of Texas, Tyler division, Case No. 6:13-cv-507-LED (Lead Case for Consolidation)
Matter: Patent infringement, 3G cellular communication
Project: Claim construction, declaration

L177. 2014 **Baker Botts LLP**
Case: Orlando Communications LLC v. AT&T, et al.
M.D. Florida, Case No. 6:14-cv-01021
Matter: Patent infringement, 3G/4G cellular communication
Project: Non-infringement and claim construction consulting

L178. 2014 **EIP US LLP**
Case: Good Technology Software, Inc. v. AirWatch, LLC
IPR2015-00248, IPR2015-00875
Matter: *Inter Partes* Review, software management in wireless devices
Project: Two declarations to support two IPR petitions

L179. 2014 **Bragalone Conroy PC**
Case: Securus Technologies, Inc. v. Global Tel*Link Corporation
IPR2015-00153, IPR2015-00155, IPR2015-00156
Matter: *Inter Partes* Review, VoIP call monitoring and recording
Project: Three declarations to support three IPR petitions, two depositions

L180. 2014 **Andrews Kurth LLP**
Case: Sony Mobile Communications (USA) v. Adaptix Inc.
IPR2014-01524, IPR2014-01525
Matter: *Inter Partes* Review, subcarrier selection in LTE
Project: Two declarations to support two IPR petitions, deposition

L181. 2014 **Steptoe & Johnson LLP; Baker & McKenzie LLP**
Case: VTech Communications, Inc. and Uniden America Corporations v. Spherix Incorporated
IPR2014-01432
Matter: *Inter Partes* Review, IP telephony
Project: Declaration to support IPR petition, deposition, reply declaration, deposition

L182. 2014 **Steptoe & Johnson LLP; Baker & McKenzie LLP**
Case: Spherix Inc. v. VTech Telecommunications Ltd., et al.
Spherix Inc. v. Uniden Corp, et al.
Northern district of Texas, Dallas division, Case No. 3:13-cv-3494 and 3:13-cv-3496
Matter: Patent infringement, IP telephony
Project: Claim construction, declaration, deposition

L183. 2014 **McKool Smith**
Case: Good Technology Corp. v. MobileIron, Inc.
Northern district of California, Case No. 5:12-cv-05826-PSG
Matter: Patent infringement, software management in wireless devices

Project: Claim construction, three declarations, claim invalidity expert report, non-infringement expert report, deposition, jury trial testimony

L184. 2014 **Lee & Hayes**
Case: Broadcom Corp. v. Ericsson, Inc.
IPR2013-00601, IPR2013-00602, and IPR2013-00636
Matter: *Inter Partes* Review, ARQ protocols
Project: Three declarations to support Patent Owner's responses, two declarations to support Patent Owner's Motion to Amend, deposition, two reply declarations

L185. 2014 **Sidley Austin LLP**
Case: Adaptix, Inc. v. Huawei Technologies Co., et al.
Eastern district of Texas, Case No. 6:13-cv-00438, 439, 440 and 441
Matter: Patent infringement, subcarrier selection in LTE
Project: Source code review, non-infringement consulting

L186. 2014 **Finnegan Henderson Farabow Garrett & Dunner LLP**
Case: Cell and Network Selection LLC v. Huawei Technologies Co., et al.
Eastern district of Texas, Case No. 6:13-cv-00404-LED-JDL
Matter: Patent infringement, base station selection in LTE
Project: Non-infringement consulting

L187. 2014 **Feinberg Day Alberti & Thompson LLP**
Case: DSS Technology Management, Inc. v. Apple Inc.
Eastern district of Texas, Tyler division, Case No. 6:13-cv-00919-JDL
Matter: Patent infringement, PDA and Bluetooth
Project: Claim construction and invalidity consulting

L188. 2014 **Sheppard Mullin Richter & Hampton LLP**
Case: Digcom Inc. v. ZTE (USA), Inc.
District of Nevada, Case No. 3:13-cv-00178-RCJ-WGC
Matter: Patent infringement, cellular communication
Project: Claim construction consulting

L189. 2014 **Lott & Fischer**
Case: Zenith Electronics, LLC, et al. v. Craig Electronics, Inc.
Southern district of Florida, Case No. 9:13-cv-80567-DMM/DLB
Matter: Patent infringement, HDTV transmission and reception
Project: Opening expert report regarding nonessentiality

L190. 2013 **McKool Smith**
Case: Zenith Electronics, LLC, et al. v. Curtis International Ltd.
Southern district of Florida, Case No. 9:13-cv-80568-DMM/DLB
Matter: Patent infringement, HDTV transmission and reception
Project: Claim construction, declaration, deposition

L191. 2013 **Gibson Dunn**
Case: Straight Path IP Group v. Sharp Corp. and Sharp Electronics Corp.
In the Matter of Certain Point-to-Point Network Communication Devices and Products Containing Same, ITC Investigation No. 337-TA-892
Matter: Patent infringement, point-to-point network communication
Project: Non-infringement consulting

L192. 2013 **Kilpatrick Townsend & Stockton LLP; Cooley LLP**
Case: Monec Holding AG v. Motorola Mobility LLC, HTC, et al.
District of Delaware, Case No. 1:11-cv-798-LPS-SRF
Matter: Patent infringement, displaying books on tablets
Project: Non-infringement expert report for Motorola, non-infringement expert report for HTC, deposition

L193. 2013 **Gartman Law Group**
Case: Lone Star WiFi LLC v. Legacy Stonebriar Hotel, Ltd; et al.
Eastern district Of Texas, Tyler, Case No. 6:12-cv-957
Matter: Patent infringement, levels of access in Wi-Fi networks
Project: Claim validity consulting

L194. 2013 **White & Case, LLP**
Case: Nokia Corp and Nokia, Inc. v. HTC Corp and HTC America, Inc. and Google, Inc.
In the Matter of Certain Portable Electronic Communication Devices, Including Mobile Phones and Components Thereof, ITC Investigation No. 337-TA-885
Matter: Patent infringement, App download and installation
Project: Non-infringement consulting

L195. 2013 **Heim, Payne & Chorush, LLP**
Case: Rembrandt Wireless v. Samsung Electronics Co., et al.
Eastern district of Texas, Marshall, Case No. 2:13-cv-213-JRG-RSP
Matter: Patent infringement, Bluetooth
Project: Expert report regarding validity, deposition, jury trial testimony

L196. 2013 **Baker Hostetler; Davis Polk & Wardwell LLP**
Case: Comcast v. Sprint; and Nextel Inc.
Eastern district of Pennsylvania, Case No. 2:12-cv-00859-JD
Matter: Patent infringement, SMS/MMS in Cellular Networks
Project: Infringement expert report, validity expert report, reply expert report, declaration, two-day depositions, jury trial testimony

L197. 2013 **McKool Smith**
Case: Samsung Electronics America v. Ericsson Inc.
In the Matter of Certain Wireless Communications Equipment and Articles Therein, ITC Investigation No. 337-TA-866
Matter: Patent infringement, LTE uplink and downlink
Project: Source code review, prior art research, claim construction, claim invalidity expert report, non-infringement expert report, ITC hearing testimony

L198. 2012 **DLA Piper US LLP**
Case: CSR Technology Inc. v. Freescale Semiconductor, Inc.
USDC-San Francisco, Case No. 3:12-cv-02619-RS
Matter: Patent infringement, radio transceivers
Project: Claim construction, declaration

L199. 2012 **Fish & Richardson P.C.**
Case: GPNE Corp. v. Apple, Inc.; et al.
USDC-ND California, Case No. 5:12-cv-02885-LHK
Matter: Patent infringement, resource allocation in wireless networks
Project: Prior art research consulting

L200. 2012 **Polsinelli Shughart PC**
Case: Single Touch Interactive, Inc. v. Zoove Corporation
Northern district of California, Case No. 3:12-cv-00831-JSC
Matter: Patent infringement, abbreviated dialing, information delivery
Project: Claim construction, Markman hearing and tech tutorial testimony, two declarations

L201. 2012 **K & L Gates**
Case: EON Corp. IP Holdings, LLC v. Novatel Wireless, Inc.; et al.
DC-Tyler, Texas, Case No. 6:11-cv-00015-LED-JDL
Matter: Patent infringement, wireless modem and 3G services
Project: Non-infringement expert report, deposition

L202. 2012 **Simpson Thacher & Bartlett LLP**
Case: CSR Technology, Inc. v. Bandspeed, Inc.
Western district of Texas, Case No. 1:12-cv-297-LY
Matter: Patent infringement, packet identification in 2.4 GHz and 5 GHz
Project: Source code review, Markman hearing and tech tutorial testimony, infringement expert report

L203. 2012 **Sheppard Mullin Richter & Hampton LLP**
Case: Wi-LAN v. HTC America, Inc., et al.
Eastern district of Texas, Case No. 6:10-cv-521-LED
Matter: Patent infringement, CDMA, Orthogonal Codes

Project: Source code review, non-infringement expert report, deposition, jury trial testimony

L204. 2012 **Dechert LLP**
Case: Hitachi v. TPV and Vizio, Inc.; and Vizio v. Hitachi, LTD.
Eastern district of Texas, Case No. 2:10-cv-260
Matter: Patent infringement, HD television transmission and reception
Project: Prior art research, claim invalidity consulting

L205. 2012 **Fish & Richardson P.C.; Covington & Burling; Alston & Bird; Brinks Hofer Gilson & Lione**
Case: InterDigital Commc'n, LLC v. Huawei Tech. Co. LTD; LG Electronics, Inc.; Nokia, Inc.; and ZTE (USA) Inc.
Certain Wireless Devices With 3G Capabilities and Components Thereof, ITC Investigation No. 337-TA-800
Matter: Patent infringement, channel coding in UMTS, HSDPA
Project: Non-infringement consulting

L206. 2012 **Fish & Richardson P.C.; Covington & Burling; Alston & Bird; Brinks Hofer Gilson & Lione**
Case: InterDigital Commc'n, LLC v. Huawei Tech. Co. LTD; LG Electronics, Inc.; Nokia, Inc.; and ZTE (USA) Inc.
District of Delaware, Case No. 1:11-cv-00654-UNA
Matter: Patent infringement, channel coding in UMTS, HSDPA
Project: Non-infringement consulting

L207. 2011 **O'Melveny & Myers LLP**
Case: MobileMedia Ideas, LLC v. Apple, Inc.
District of Delaware, Case No. 1:10-cv-00258-SLR-MPT
Matter: Patent infringement, voice control, call rejection in mobile phones
Project: Source code review, prior art research, declaration, claim invalidity expert report, non-infringement expert report, deposition, jury trial testimony

L208. 2011 **Wilmer Cutler Pickering Hale and Dorr**
Case: Apple, Inc. v. Samsung Electronics Co.
Northern district of California, Case No. 5:11-cv-01846-LHK
Matter: Patent infringement, channel coding in CDMA, E-AGCH, TFCI
Project: Prior art research, claim construction consulting

L209. 2011 **Weil, Gotshal & Manges LLP**
Case: Vizio, Inc. v. Renesas Electronics America, Inc.
ITC Investigation No. 337-TA-789
Matter: Patent infringement, HD television transmission and reception
Project: Claim invalidity consulting

L210. 2011 **Shapiro Cohen**
Case: TenXc Wireless Inc. v. Andrew LLC
TenXc Wireless Inc. v. Mobi Antenna Technologies Ltd.
Matter: Patent infringement, antenna design, sectorized cellular network
Project: Claim validity consulting

L211. 2010 **Fish & Richardson P.C.**
Case: Vizio, Inc., v. LG Electronics, Inc.
ITC Investigation No. 337-TA-733
Matter: Patent infringement, HD television transmission and reception
Project: Claim charts, claim construction expert report, deposition

L212. 2010 **Fish & Richardson P.C.**
Case: Vizio, Inc., v. LG Electronics, Inc.
District of Maryland, Case No. 1:09-cv-1481-BEL
Matter: Patent infringement, HD television transmission and reception
Project: Claim charts, claim construction expert report, deposition

L213. 2008 **Kaye Scholer LLP**
Case: eBay Inc. v. IDT.
Western district of Arkansas, Case No. 4:08-cv-4015-HFB
Matter: Patent infringement, long distance communication using Internet
Project: Prior art research, claim construction consulting

L214. 2008 **Simpson Thacher & Bartlett LLP**
Case: Commil USA, LLC v. Cisco Systems, Inc.
Eastern district of Texas, Case No. 2:07-cv-00341-DF-CE
Matter: Patent infringement, two-level wireless protocol
Project: Prior art research

L215. 2006 **Woodfill and Pressler**
Case: Charles Russell v. Interinsurance Exchange of the Auto Club
Harris County, Texas, Case No. 2005-19706
Matter: House fire and insurance claim
Project: Determining user location using cellular phone records, expert report, deposition, jury trial testimony

Consulting History

From: 11/2022 **Abe, Ikubo & Katayama (Client: ASUS Japan K.K.)**
To: 12/2022 Japan
Duties: Analyze 3GPP standards contribution.

From: 8/2022 **JLP Enterprise Holdings LLC**
To: 8/2022 Dallas, TX
Duties: Analyze patents for essentiality to 5G standards.

From: 5/2022 **Washington Utilities and Transportation Commission DOCKET UT-181051**
To: 12/2022 Olympia, WA
Duties: Analyze cause(s) of network failure, provide testimony on behalf of Staff, deposition, hearing testimony

From: 8/2021 **Carter Arnett (Client: G+ Communications)**
To: 5/2022 Dallas, TX
Duties: Analyze patents for essentiality to 4G and 5G standards.

From: 2/2021 **ExpertsDirect Pty Ltd**
To: 3/2021 Australia
Duties: Analyze antenna arrays.

From: 11/2020 **Licks Attorneys**
To: 1/2021 Brazil
Duties: Analyze patents for essentiality to 4G standards.

From: 6/2019 **Fish & Richardson, P.C. (Client: Huawei)**
To: 5/2022 Dallas, TX
Duties: Analyze patents for essentiality to 3G, 4G, and 5G standards.

From: 1/2013 **Heim, Payne & Chorush, LLP**
To: 3/2013 Houston, TX
Duties: Analyze patents on wireless technologies.

From: 4/2007 **Collin County Sheriff's Office**
To: 5/2007 McKinney, TX
Duties: Analyzed cellular record data and determined user location in a double-homicide investigation.

From: 4/2004 **Allegiant Integrated Solutions**
To: 5/2004 Fort Worth, TX
Duties: Designed and developed an integrated set of tools for fast deployment of wireless networks. The tools optimize the placement of Access Points and determine their respective channel allocations to minimize interference and maximize capacity.

From: 3/2002 **Input/Output Incorporated**
To: 4/2002 New Orleans, LA
Duties: Designed and implemented an algorithm in MATLAB for optimizing the frequency selection process used by sonar for scanning the bottom of the ocean.

From: 6/1998 **Teleware Corporation**

To: 7/1998 Seoul, South Korea
Duties: Designed and developed a software package for analyzing the capacity in a CDMA network to maximize the number of subscribers.

Employment History

From: 5/2023 **University of North Texas**
To: Present Denton, TX
Position: *Tenured Professor Department of Computer Science and Engineering*
Conducting research on MIMO and 5G cellular networks. Teaching telecommunication courses. Advising graduate and undergraduate students.

From: 1/2015 **University of North Texas**
To: 8/2021 Denton, TX
Position: *Associate Chair of Graduate Studies Department of Computer Science and Engineering*
In charge of all administrative duties related to the Master's and Ph.D. programs in the department.

From: 5/2008 **University of North Texas**
To: 5/2023 Denton, TX
Position: *Tenured Associate Professor Department of Computer Science and Engineering*
Conducting research on cellular networks and wireless sensor networks. Teaching wireless communication courses. Advising graduate and undergraduate students.

From: 9/2002 **University of North Texas**
To: 5/2008 Denton, TX
Position: *Assistant Professor Department of Computer Science and Engineering*
Conducting research on WCDMA/UMTS wireless networks. Teaching wireless communication and computer architecture courses. Advising graduate and undergraduate students.

From: 1/2002 **University of New Orleans**
To: 8/2002 New Orleans, LA
Position: *Assistant Professor Department of Electrical Engineering*
Designed and taught two new courses "Computer Systems Design I and II". Developed a Computer Engineering Curriculum with strong hardware-design emphasis. Formed a wireless research group. Advised graduate and undergraduate students.

From: 10/2000 **Comspace Corporation**
To: 12/2001 Coppell, TX
Position: *Senior Systems Engineer*

Designed, coded (in MATLAB), and simulated Viterbi decoding, Turbo coding, trellis coded modulation (TCM), and Reed-Muller codes. Optimized soft decision parameters and interleavers for additive white Gaussian and Rayleigh faded channels. Extended the control and trunking of push-to-talk Logic Trunked Radio (LTR) to include one-to-one and one-to-many voice and data messaging.

From: 8/1997 **MinMax Corporation**
To: 5/1999 Saint Louis, MO
Position: *Research Associate*
Designed software packages that provide the tools to flexibly allocate capacity in a CDMA network and maximize the number of subscribers. Analyzed and simulated different audio compression schemes. Validated, simulated (logical and timing), and developed the hardware architecture for an ATM switch capable of channel group switching.

From: 8/1994 **Washington University**
To: 8/2000 Saint Louis, MO
Position: *Research and Teaching Assistant*
Taught, consulted, and graded Circuit Analysis at the undergraduate level and Network Design at the graduate level.

Publications

Conference Proceedings

C1. R. Chataut, **R. Akl**, "An Adaptive User Scheduling Algorithm for 6G Massive MIMO Systems," *26th IEEE International Conference on Advanced Communications Technology (IEEE ICACT 2024)*, February 2024, pp. 1475-1482.

C2. R. Chataut, **R. Akl**, U.K. Dey, "An Adaptive User Scheduling Algorithm for 6G Massive MIMO Systems," *25th IEEE International Conference on Advanced Communications Technology (IEEE ICACT 2023)*, February 2023, pp. 158-163.

C3. U.K. Dey, **R. Akl**, R. Chataut, "Performance Improvement in Cellular V2X (CV2X) by Using Massive MIMO Jacobi Detector," *2022 IEEE 19th International Conference on Smart Communities: Improving Quality of Life Using ICT, IoT and AI (HONET)*, December 2022, pp. 122-127.

C4. U.K. Dey, **R. Akl**, R. Chataut, "Performance Improvement in Cellular V2X (CV2X) by Using Low Density Parity Check (LDPC) Code," *2022 IEEE 13th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*, October 2022, pp. 296-302.

C5. M. Robaei, **R. Akl**, "Distributed Compressed Sensing Karhunen-Loéve Expansion - Application to Millimeter-Wave Resource Allocation Through Group

Beamforming," *2022 IEEE International Workshop Technical Committee on Communications Quality and Reliability (CQR)*, September 2022, pp. 7-12.

C6. R. Chataut, **R. Akl**, U.K. Dey, "Massive MIMO Uplink Signal Detector for 5G and Beyond Networks," *2022 IEEE Texas Symposium on Wireless and Microwave Circuits and Systems (WMCS)*, April 2022, 7 pgs.

C7. M. Robaei, **R. Akl**, R. Chataut, U.K. Dey, "Adaptive Millimeter-Wave Channel Estimation and Tracking," *2022 24th International Conference on Advanced Communication Technology (ICACT)*, February 2022, pp. 23-28.

C8. U.K. Dey, **R. Akl**, R. Chataut, "Throughput Improvement in Vehicular Communication by Using Low Density Parity Check (LDPC) Code," *IEEE CCWC 2022 The 12th Annual Computing and Communication Workshop and Conference*, January 2022, pp. 836-843.

C9. U.K. Dey, **R. Akl**, R. Chataut, M. Robaei, "Selective MIMO in Vehicular Communication for Reliable Safety Services and High Speed Non-Safety Services," *2021 IEEE 12th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*, 2021, pp. 785-790, 6 pgs.

C10. R. Chataut, **R. Akl**, U.K. Dey, "An Efficient and Fast-convergent Detector for 5G and Beyond Massive MIMO Systems," *2021 IEEE 12th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*, 2021, pp. 866-872, 7 pgs.

C11. M. Robaei, **R. Akl**, "Millimeter-Wave Blockage Modeling And Mitigation," *2021 IEEE International Workshop Technical Committee on Communications Quality and Reliability (CQR 2021)*, 2021, 6 pgs.

C12. M. Robaei, **R. Akl**, "Characterizing Non-Stationary Millimeter-Wave Communication Using Fuzzy Entropy," *2021 55th Annual Conference on Information Sciences and Systems (CISS)*, 2021, 6 pgs.

C13. M. Robaei, **R. Akl**, R. Chataut, U.K. Dey, "Adaptive Millimeter-Wave Channel Estimation and Tracking," *2021 23rd International Conference on Advanced Communication Technology (ICACT)*, February 2021, pp. 23-28, 6 pgs.

C14. U.K. Dey, **R. Akl**, R. Chataut, M. Robaei, "Modified PHY Layer for High Performance V2X Communication using 5G NR," *IEEE UEMCON 11th IEEE Annual Ubiquitous Computing, Electronics & Mobile Communication Conference*, October 2020, pp. 137-142, 6 pgs.

C15. R. Chataut, **R. Akl**, "An Efficient and Fair Scheduling for Downlink 5G Massive MIMO Systems," *IEEE Texas Symposium on Wireless and Microwave Circuits and Systems*, June 2020, paper no.TSWMCS2020-39, 8 pgs.

C16. R. Chataut, **R. Akl**, "Efficient and Low-Complexity Iterative Detectors for 5G Massive MIMO Systems," *IEEE DCOSS 2020 International Conference on Distributed Computing in Sensor Systems*, May 2020, pp. 442-449, 8 pgs.

C17. U.K. Dey, **R. Akl**, R. Chataut, "High Throughput Vehicular Communication Using Spatial Multiplexing MIMO," *IEEE CCWC 2020 The 10th Annual Computing and Communication Workshop and Conference*, January 2020, paper no. 1570613408, 6 pgs.

C18. R. Chataut, **R. Akl**, M. Robaei, "Accelerated and Preconditioned Refinement of Gauss-Seidel Method for Uplink Signal Detection in 5G Massive MIMO Systems," *IEEE CCWC 2020 The 10th Annual Computing and Communication Workshop and Conference*, January 2020, paper no. 1570605343, 7 pgs.

C19. M. Robaei, **R. Akl**, "Examining Spatial Consistency for Millimeter-Wave Massive MIMO Channel Estimation in 5G-NR," *IEEE ICCE 2020 The 38th International Conference on Consumer Electronics*, January 2020, paper no. 1570596880, 6 pages.

C20. R. Chataut, **R. Akl**, "Channel Gain Based User Scheduling for 5G Massive MIMO Systems," *IEEE HONET-ICT 2019 The 16th International Conference on Smart Cities: Improving Quality of Life Using ICT & IoT and AI*, October 2019, paper no. 1570565594, 5 pgs.

C21. M. Robaei, **R. Akl**, "Time-Variant Broadband mmWave Channel Estimation Based on Compressed Sensing," *IEEE UEMCON 2019 The 10th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference*, October 2019, paper no. 1570577430, 7 pages.

C22. R. Chataut, **R. Akl**, U. Dey, "Least Square Regressor Selection Based Detection for Uplink 5G Massive MIMO Systems," *IEEE WAMICON 2019 The 20th Annual IEEE Wireless and Microwave Technology Conference*, April 2019, paper no. 1570524727, 6 pgs.

C23. R. Chataut, **R. Akl**, "Huber Fitting Based ADMM Detection for Uplink 5G Massive MIMO Systems," *IEEE UEMCON 2018 The 9th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference*, November 2018, paper no. 1570492416, 5 pgs.

C24. R. Chataut, **R. Akl**, "Efficient and Low Complex Uplink Detection for 5G Massive MIMO Systems," *IEEE WAMICON 2018 The 19th Annual Wireless and Microwave Technology Conference*, April 2018, paper no. 1570431593, 6 pgs.

C25. R. Chataut, **R. Akl**, "Optimal Pilot Reuse Factor Based on User Environments in 5G Massive MIMO," *IEEE CCWC 2018 The 8th Annual Computing and*

Communication Workshop Conference, January 2018, paper no. 1570413394, 6 pgs.

C26. S. Alotaibi, **R. Akl**, "Radio Resource Management in LTE Femtocell Networks," *IEEE NCA '17 International Symposium on Network Computing and Applications*, November 2017, paper no. 117, 5 pgs.

C27. U. Sawant, **R. Akl**, "Subcarrier Allocation in LTE Network Deployment with Mobility," *IEEE UEMCON 2017 8th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference*, October 2017, paper no. 1570349184, 8 pgs.

C28. S. Alotaibi, **R. Akl**, "Packet Scheduling Bandwidth Type-Based Mechanism for LTE," *IEEE UEMCON 2017 8th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference*, October 2017, paper no. 1570394639, 6 pgs.

C29. S. Alotaibi, **R. Akl**, "Dynamic Fractional Frequency Reuse (FFR) Scheme for Two-Tier Network in LTE," *IEEE UEMCON 2017 8th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference*, October 2017, paper no. 1570394969, 6 pgs.

C30. U. Sawant, **R. Akl**, "Evaluation of Adaptive and Non Adaptive LTE Fractional Frequency Reuse Mechanisms," *IEEE WOCC 2017 The 26th Annual Wireless and Optical Communications Conference*, April 2017, paper no. 1570341174, 6 pgs.

C31. S. Alotaibi, **R. Akl**, "Range-Based Scheme for Adjusting Transmission Power for Femtocells in Co-Channel Deployment," *IEEE WTS 2017 The 16th Annual Wireless Telecommunications Symposium*, April 2017, paper no. 1570334744, 5 pgs.

C32. U. Sawant, **R. Akl**, "A Novel Metric to Study the Performance of Sectorized Fractional Frequency Reuse Techniques in LTE," *IEEE WTS 2017 The 16th Annual Wireless Telecommunications Symposium*, April 2017, paper no. 1570338498, 7 pgs.

C33. S. Alotaibi, **R. Akl**, "Dynamic Frequency Partitioning Scheme for LTE HetNet Networks Using Fractional Frequency Reuse," *IEEE WCNC '17 Wireless Communications and Networking Conference*, March 2017, paper no. 1570332420, 5 pgs., demo and poster.

C34. U. Sawant, **R. Akl**, "Performance Evaluation of Network Productivity for LTE Heterogenous Networks with Reward-Penalty Weights Assessment," *IEEE CCWC 2017 The 7th Annual Computing and Communication Workshop Conference*, January 2017, paper no. 1570328396, 6 pgs.

C35. S. Alotaibi, **R. Akl**, "Self-Adjustment Downlink Transmission Power for Femtocells in Co-Channel Deployment in Heterogeneous Networks," *IEEE CCWC 2017 The 7th Annual Computing and Communication Workshop Conference*, January 2017, paper no. 1570326815, 6 pgs.

C36. U. Sawant, **R. Akl**, "Performance Evaluation of Sectorized Fractional Frequency Reuse Techniques Using Novel Metric," *IEEE ISCC 2016 The Twenty-First IEEE Symposium on Computers and Communications*, June 2016, paper no. 1570275270, 7 pgs.

C37. R. Tidwell, S. Akumalla, S. Karlaputi, **R. Akl**, K. Kavi, and D. Struble, "Evaluating the Feasibility of EMG and Bend Sensors for Classifying Hand Gestures," *1st International Conference on Multimedia and Human Computer Interaction*, July 2013, paper no. 63, 8 pgs.

C38. **R. Akl**, K. Pasupathy, and M. Haidar, "Anchor Nodes Placement for Effective Passive Localization," *2011 IEEE International Conference on Selected Topics in Mobile and Wireless Networks (iCOST)*, October 2011, paper no. 1569490799, pp. 127 - 132.

C39. **R. Akl**, P. Kadiyala, and M. Haidar, "Non-Uniform Grid-Based Routing in Sensor Networks," *9th IEEE Malaysia International Conference on Communications*, December 2009, paper no. 1569243649, pp. 536 - 540.

C40. M. Haidar, M. Al-Rizzo, Y. Chan, **R. Akl**, M. Bouharras, "Throughput Validation of an Advanced Channel Assignment Algorithm in IEEE 802.11 WLAN," *ICCSN 2009 – International Conference on Communication Software and Networks*, February 2009, paper no. P385, pp. 801 - 806.

C41. **R. Akl** and D. Keathly, "Robocamp: Encouraging Young Women to Embrace STEM," 4th Annual TETC Best Practices Conference, February 2009, 13 pgs.

C42. M. Haidar, R. Ghimire, M. Al-Rizzo, **R. Akl**, Y. Chan, "Channel Assignment in an IEEE 802.11 WLAN Based on Signal-to-interference Ratio," *IEEE CCECE – Canadian Conference on Electrical and Computer Engineering: Communications and Networking*, May 2008, paper no. 1569092894, pp. 1169 - 1174.

C43. H. Al-Rizzo, M. Haidar, **R. Akl**, and Y. Chan, "Enhanced Channel Assignment and Load Distribution in IEEE 802.11 WLANs," *IEEE International Conference on Signal Processing and Communication*, November 2007, paper no. 1569042132, pp. 768 - 771.

C44. **R. Akl** and Y. Saravanos, "Hybrid Energy-Aware Synchronization Algorithm in Wireless Sensor Networks," *18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications*, September 2007, paper no 692, 5 pgs.

C45. M. Haidar, **R. Akl**, and H. Al-Rizzo, "Channel Assignment and Load Distribution in a Power-Managed WLAN," *18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications*, September 2007, paper no. 463, 5 pgs.

C46. D. Keathly and **R. Akl,** "Attracting and Retaining Women in Computer Science and Engineering: Evaluating the Results," *Proceedings of American Society for Engineering Education: ASEE Annual Conference*, June 2007, paper no. AC 2007-1229, 10 pgs.

C47. M. Haidar, **R. Akl**, H. Al-Rizzo, Y. Chan, R. Adada, "Optimal Load Distribution in Large Scale WLAN Networks Utilizing a Power Management Algorithm," *Proceedings of IEEE Sarnoff Symposium*, May 2007, 5 pgs.

C48. R. Dantu, P. Kolan, **R. Akl,** and K. Loper, "Classification of Attributes and Behavior in Risk Management Using Bayesian Networks," *Proceedings of IEEE Intelligence and Security Informatics Conference*, May 2007, pp. 71-74.

C49. **R. Akl** and A. Arepally, "Dynamic Channel Assignment in IEEE 802.11 Networks," *Proceedings of IEEE Portable 2007: International Conference on Portable Information Devices*, March 2007, pp 309-313.

C50. **R. Akl** and U. Sawant, "Grid-based Coordinated Routing in Wireless Sensor Networks," *Proceedings of IEEE CCNC 2007: Consumer Communications and Networking Conference*, January 2007, pp. 860-864.

C51. **R. Akl** and A. Arepally, "Simulation of Throughput in UMTS Networks with Different Spreading Factors," *Proceedings of IEEE VTC Fall 2006: Vehicular Technology Conference,* September 2006, pp. C1-5.

C52. A. Alhabsi, H. Al-Rizzo, and **R. Akl,** "Parity Assisted Decision Making for QAM Modulation," *International Conference on Mobile Computing and Wireless Communications*, September 2006, paper no. 1568988776, 5 pgs.

C53. **R. Akl** and R. Garlick**,** "Retention and Recruitment of Women in Computer Engineering," *ICEE 2006: International Conference on Engineering Education,* July 2006, paper no. 3318, 5 pgs.

C54. R. Garlick and **R. Akl,** "Intra-Class Competitive Assignments in CS2: A One-Year Study," *ICEE 2006: International Conference on Engineering Education,* July 2006, paper no. 3325, 5 pgs.

C55. **R. Akl**, D. Tummala, and X. Li, "Indoor Propagation Modeling at 2.4 GHz for IEEE 802.11 Networks," *WNET 2006: Wireless Networks and Emerging Technologies,* July 2006, paper no. 510-014, 6 pgs.

C56. P. Chen, K. Kavi, and **R. Akl,** "Performance Enhancement by Eliminating Redundant Function Execution," *Proceedings of IEEE: 39th Annual Simulation Symposium*, April 2006, pp. 143-150.

C57. **R. Akl** and S. Nguyen, "Capacity Allocation in Multi-cell UMTS Networks for Different Spreading Factors with Perfect and Imperfect Power Control," *Proceedings of IEEE CCNC 2006: Consumer Communications and Networking Conference*, January 2006, vol. 2, pp. 928-932.

C58. W. Li, K. Kavi, and **R. Akl**, "An Efficient Non-Preemptive Real-Time Scheduling," *18th International Conference on Parallel and Distributed Computing Systems*, Las Vegas, NV, September 2005, pp. 154-160.

C59. S. Nguyen and **R. Akl**, "Approximating User Distributions in WCDMA Networks Using 2-D Gaussian," *CCCC20T 05: International Conference on Computing, Communications, and Control Technologies*, July 2005, 5 pgs.

C60. **R. Akl** and S. Park, "Optimal Access Point Selection and Traffic Allocation in IEEE 802.11 Networks," *Proceedings of 9th World Multiconference on Systemics, Cybernetics and Informatics (WMSCI 2005): Communication and Network Systems, Technologies and Applications*, July 2005, vol. 8, pp. 75-79.

C61. **R. Akl**, M. Naraghi-Pour, M. Hegde, "Throughput Optimization in Multi-Cell CDMA Networks," *IEEE WCNC 2005 - Wireless Communications, and Networking Conference*, March 2005, vol. 3, pp. 1292-1297.

C62. **R. Akl**, "Subscriber Maximization in CDMA Cellular Networks," *Proceedings of CCCT 04: International Conference on Computing, Communications, and Control Technologies*, August 2004, vol. 3, pp. 234-239.

C63. **R. Akl** and A. Parvez, "Global versus Local Call Admission Control in CDMA Cellular Networks," *Proceedings of CITSA 04: Communications, Information and Control Systems, Technologies and Applications*, July 2004, vol. 2, pp. 283-288.

C64. **R. Akl** and A. Parvez, "Impact of Interference Model on Capacity in CDMA Cellular Networks," *Proceedings of SCI 04: Communication and Network Systems, Technologies and Applications*, July 2004, vol. 3, pp. 404-408. Selected as **best paper** of those presented in the session: Tele-Communication Systems, Technologies and Application II.

C65. **R.G. Akl**, M.V. Hegde, M. Naraghi-Pour, P.S. Min, "Call Admission Control Scheme for Arbitrary Traffic Distribution in CDMA Cellular Systems," *IEEE Wireless Communications and Networking Conference*, September 2000, vol. 1, pp. 465-470.

C66. **R.G. Akl**, M.V. Hegde, M. Naraghi-Pour, P.S. Min, "Cell Placement in a CDMA Network," *IEEE Wireless Communications and Networking Conference*, September 1999, vol. 2, pp. 903-907.

C67. **R.G. Akl**, M.V. Hegde, P.S. Min, "Effects of Call Arrival Rate and Mobility on Network Throughput in Multi-Cell CDMA," *IEEE International Conference on Communications*, June 1999, vol. 3, pp. 1763-1767.

C68. **R.G. Akl**, M.V. Hegde, M. Naraghi-Pour, P.S. Min, "Flexible Allocation of Capacity in Multi-Cell CDMA Networks," *IEEE Vehicular Technology Conference*, May 1999, vol. 2, pp. 1643-1647.

Journal Publications

J1. R. Chataut, M. Nankya, **R. Akl**, "6G Networks and the AI Revolution – Exploring Technologies, Applications, and Emerging Challenges," *Sensors 2024,* March 2024, 29 pgs.

J2. R. Chataut, **R. Akl**, "An Adaptive User Scheduling Algorithm for 6G Massive MIMO Systems," *IEEE Transactions on Advanced Communications Technology*, November 2023, 8 pgs.

J3. M. Nankya, R. Chataut, **R. Akl**, "Securing Industrial Control Systems: Components, Cyber Threats, and Machine Learning-Driven Defense Strategies," *Sensors 2023,* October 2023, 41 pgs.

J4. R. Chataut, A. Phoummalayvane, **R. Akl**, "Unleashing the Power of IoT: A Comprehensive Review of IoT Applications and Future Prospects in Healthcare, Agriculture, Smart Homes, Smart Cities, and Industry 4.0," *Sensors 2023*, August 2023, 19 pgs.

J5. M. Robaei, **R. Akl**, "Quadratic Displacement Operators—Theory and Application to Millimeter-Wave Channel Tracking," *IEEE Transactions on Wireless Communications,* January 2023, Vol. 22, No. 1, 15 pgs.

J6. M. Robaei, **R. Akl**, "Continuous Compressed Sensing Hilbert-Schmidt Integral Operator," *IEEE Access*, August 2022, pp. 80264-80276.

J7. R. Chataut, **R. Akl**, U.K. Dey, M. Robaei, "SSOR Preconditioned Gauss-Seidel Detection and Its Hardware Architecture for 5G and beyond Massive MIMO Networks," *Electronics 2021 ISSN 2079-9292*, 10(5), 578, *Special Issue MIMO for Next Generation Wireless Systems,* March 2021, 17 pgs.

J8. R. Chataut, **R. Akl**, "Massive MIMO Systems for 5G and Beyond Networks – Overview, Recent Trends, Challenges, and Future Research Direction," *Sensors 2020*, 20(10), 2753, May 2020.

J9. R. Chataut, **R. Akl,** "Massive MIMO Systems for 5G," *Encyclopedia 2020*, doi:10.32545, 2020, (ISSN 2309-3366).

J10. S. Alotaibi, **R. Akl**, "Range-Based Scheme for Adjusting Transmission Power of Femtocell in Co-Channel Deployment," *International Journal of Interdisciplinary Telecommunications and Networking*, IJITN Vol. 10, No. 4, pgs. 14-24, 2018.

J11. U. Sawant, **R. Akl**, "Adaptive and Non Adaptive LTE Fractional Frequency Reuse Mechanisms Mobility Performance," *Advances in Science, Technology and Engineering Systems Journal*, ASTES Vol. 3, No. 3, 02-11, 11 pgs., 2018.

J12. M. Haidar, H.M. Al-Rizzo, **R. Akl**, and Z. Elbazzal, "The Effect of an Enhanced Channel Assignment Algorithm in an IEEE 802.11 WLAN," *World Scientific and Engineering Academy and Society Transactions on Communications*, WSEAS, Vol. 8, Issue 12, December 2009.

J13. **R. Akl**, P. Kadiyala, and M. Haidar, "Non-Uniform Grid-Based Coordinated Routing in Wireless Sensor Networks," *Journal of Sensors*, article ID 491349, volume 2009, 11 pages.

J14. M. Haidar, M. Al-Rizzo, Y. Chan, **R. Akl**, "User-Based Channel Assignment Algorithm in a Load-Balanced IEEE 802.11 WLAN," *International Journal of Interdisciplinary Telecommunications & Networking (IJITN)*, April-June 2009, 1(2), pp. 66-81.

J15. **R. Akl**, D. Keathly, and R. Garlick, "Strategies for Retention and Recruitment of Women and Minorities in Computer Science and Engineering," *iNEER Special Volume: Innovations 2007- World Innovations in Engineering Education and Research*, 9 pgs., 2007.

J16. R. Garlick and **R. Akl**, "Motivating and Retaining CS2 Students with a Competitive Game Programming Project," *iNEER Special Volume: Innovations 2007- World Innovations in Engineering Education and Research*, 9 pgs., 2007.

J17. **R. Akl** and S. Nguyen, "UMTS Capacity and Throughput Maximization for Different Spreading Factors," *Journal of Networks*, July 2006, vol. 1, issue 3, pp. 40-49. ISSN: 1796-2056

J18. W. Li, K. Kavi, and **R. Akl**, "A Non-preemptive Scheduling Algorithm for Soft Real-time Systems," *Journal of Computer and Electrical Engineering,* 2006, vol. 32, 18 pgs. ISSN: 0045-7906

J19. **R. Akl**, A. Parvez, and S. Nguyen, "Effects of Interference on Capacity in Multi-Cell CDMA Networks," *Journal of Systemics, Cybernetics and Informatics*, 2006, vol. 3, no. 1, p825612, 7 pgs. ISSN: 1690-4524

J20. **R.G. Akl**, M. Hegde and M. Naraghi-Pour, "Mobility-based CAC Algorithm for Arbitrary Traffic Distribution in CDMA Cellular Systems," *IEEE Transactions on Vehicular Technology,* March 2005*,* vol. 54, no. 2, pp. 639-651.

J21. **R.G. Akl**, M.V. Hegde, M. Naraghi-Pour, P.S. Min, "Multi-Cell CDMA Network Design," *IEEE Transactions on Vehicular Technology*, May 2001, vol. 50, no. 3, pp. 711-722.

Technical Papers

T1. J. Williams, **R. Akl,** et al, "Flight Control Subsystem," *The Eagle Feather*, Special Section: Undergraduate Research Initiative in Engineering, University of North Texas, Vol. 7, 2010.

T2. **R.G. Akl**, M.V. Hegde, A. Chandra, P.S. Min, "CDMA Capacity Allocation and Planning," Technical Document, Washington University Department of Electrical Engineering WUEE-98, April 1998.

Book Chapters

B1. R. Akl, Y. Saravanos, and M. Haidar, "Chapter 18: Hybrid Approach for Energy-Aware Synchronization in Sensor Networks," *Sustainable Wireless Sensor Networks*, December 2010, pgs. 413-429, ISBN: 978-953-307-297-5.

B2. K. Kavi, **R. Akl** and A. Hurson, "Real-Time Systems: An Introduction and the State-of-the-Art," *Encyclopedia of Computer Science and Engineering*, John Wiley & Sons, Volume 4, January 2009, pgs. 2369-2377.

B3. **R. Akl** and K. Kavi, "Chapter 12: Modeling and Analysis using Computational Tools," *Introduction to Queuing Theory: Modeling and Analysis*, Birkhauser Boston, December 2008, pgs. 295-320.

Technical Presentations

P1. "Bio-Com Project," Raytheon, Richardson TX, May 2012, (invited).

P2. "Bio-Com Project," Net-Centric Software and Systems I/UCRC Meeting, Denton TX, December 2011, (invited).

P3. "Student Outreach Report: Robocamp," College of Engineering Advisory Board Meeting, Denton TX, May 2011, (invited).

P4. "Robocamp: Encouraging Young Women to Embrace STEM," 4th Annual TETC Best Practices Conference, Austin TX, February 2009, (invited).

P5. "Self-Configuring Wireless MEMS Network (demo)," Southern Methodist

University, Dallas TX, January 2008, (invited).

P6. "Energy-aware Routing and Hybrid Synchronization in Sensor Networks," *Southern Methodist University,* Dallas TX, September 2007, (invited).

P7. "Retention and Recruitment of Women in Computer Engineering," *ICEE 2006: International Conference on Engineering Education,* Puerto Rico, July 2006, (refereed).

P8. "Capacity Allocation in Multi-cell UMTS Networks for Different Spreading Factors with Perfect and Imperfect Power Control," *IEEE CCNC 2006: Consumer Communications and Networking Conference*, Las Vegas, NV, January 2006, (refereed).

P9. "Research, Teaching, and Outreach," CSE Advisory Council Meeting, *UNT Research Park*, Denton, TX, December 2005, (invited).

P10. "Wi-Fi and WCDMA Network Design," *University of Arkansas*, Little Rock, AR, April 2005, (invited).

P11. "Wi-Fi and WCDMA Network Design," *Southern Methodist University*, Dallas, TX, March 2005, (invited).

P12. "Current Research in Wireless at UNT," *Nortel Networks*, Richardson, TX, October 2004, (invited).

P13. "Subscriber Maximization in CDMA Cellular Networks," *International Conference on Computing, Communications, and Control Technologies*, Austin, TX, August 2004, (refereed).

P14. "Global versus Local Call Admission Control in CDMA Cellular Networks," *International Conference on Cybernetics and Information Technologies, Systems and Applications*, Orlando, FL, July 2004, (refereed).

P15. "Impact of Interference Model on Capacity in CDMA Cellular Networks," *8th World Multi-Conference on Systemics, Cybernetics, and Informatics*, Orlando, FL, July 2004, (refereed).

P16. "CDMA Network Design," IEEE Communications Society – New Orleans Chapter, New Orleans, LA, May 2002, (invited).

P17. "Cell Design to Maximize Capacity in CDMA Networks," Louisiana State University, Baton Rouge, LA, April 2002, (invited).

P18. "Call Admission Control Scheme for Arbitrary Traffic Distribution in CDMA Cellular Systems," *IEEE Wireless Communications and Networking Conference*,

Chicago, IL, September 2000, (refereed).

P19. "Cell Placement in a CDMA Network," *IEEE Wireless Communications and Networking Conference*, September 1999, (refereed).

P20. "Effects of Call Arrival Rate and Mobility on Network Throughput in Multi-Cell CDMA," *IEEE International Conference on Communications*, June 1999, (refereed).

P21. "Flexible Allocation of Capacity in Multi-Cell CDMA Networks," *IEEE Vehicular Technology Conference*, May 1999, (refereed).

P22. "CCAP: A Strategic Tool for Managing Capacity of CDMA Networks," Teleware Co. Ltd., Seoul, South Korea, 1998, (invited).

Courses Developed

- CSCE 5933: LTE Physical Layer Using MATLAB.
  Research issues in the design of LTE physical layer and simulate using MATLAB. Topics include modulation and coding, OFDM, channel modeling, MIMO, and link adaption.

- CSCE 6590: Advanced Topics in Wireless Communications & Networks: 4G/LTE.
  Research issues in the design of next generation wireless networks: cellular systems, medium access techniques, signaling, mobility management, control and management for mobile networks, wireless data networks, Internet mobility, quality-of-service for multimedia applications, caching for wireless web access, and ad hoc networks.

- CSCE 5933: Fundamentals of VoIP.
  Fundamentals of VoIP, with emphasis on network infrastructure implementation and security. Topics include IP protocol suite, SS7, speech-coding techniques, quality of service, session initiation protocol, and security issues.

- CSCE 5540: Introduction to Sensor Networks.
  Topics include: design implications of energy (hardware and software), and otherwise resource-constrained nodes; network self-configuration; services such as routing under network dynamics, localization, time-synchronization and calibration; distributed data management, in-network aggregation and collaborative signal processing, programming tools and language support.

- CSCE 5510. Wireless Communication.
  Point-to-point signal transmission through a wireless channel, channel capacity, channel encoding, and multi-user transmissions. First, second, and third generation cellular systems, and mobility management.

- CSCE 3510. Introduction to Wireless Communication.
  Fundamentals of wireless communications and networking, with emphasis on first, second, and third generation cellular systems. Topics include point-to-point signal transmission through a wireless channel, cellular capacity, multi-user transmissions, and mobility management.

- CSCE 3020. Communications Systems.
  Introduction to the concepts of transmission of information via communication channels. Amplitude and angle modulation for the transmission of continuous-time signals. Analog-to-digital conversion and pulse code modulation. Transmission of digital data. Introduction to random signals and noise and their effects on communication. Optimum detection systems in the presence of noise.

- ENEE 3583. Computer Systems Design I (UNO).
  The design process of digital computer systems is studied from the instruction set level, system architecture level, and digital logic level. Topics include machine organization, register transfer notation, processor design, memory design, and input/output considerations. Includes semester project.

- ENEE 3584. Computer Systems Design II (UNO).
  The design and evaluation of contemporary computer systems are analyzed to compare the performance of different architectures. Topics include performance metrics, computer arithmetic, pipelining, memory hierarchies, and multiprocessor systems.

- ENEE 3514. Computer Architecture Laboratory (UNO).
  Selected experiments examining programmable logic, VHDL and logic synthesis, and including a final design project, to accompany and complement the lecture course ENEE 3584. Three hours of laboratory.

Courses Taught

Spring 2025
- CSCE 3020.1: Communication Systems (no evaluation yet)

Spring 2024
- CSCE 3020.1: Communication Systems (4.0 / 5.0)

Fall 2023
- CSCE 3010.1: Signals and Systems (3.6 / 5.0)

Spring 2023
- CSCE 3020.1: Communication Systems (4.5 / 5.0)

Fall 2022
- CSCE 3010.1: Signals and Systems (4.4 / 5.0)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2022
- CSCE 3020.1: Communication Systems (4.2 / 5.0)

- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2021
- CSCE 3010.1: Signals and Systems (4.2 / 5.0)
- CSCE 5933.1: LTE Physical Layer Using MATLAB (5.0 / 5.0)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2021
- CSCE 2610.2: Computer Organization (4.0 / 5.0)
- CSCE 3020.1: Communication Systems (4.2 / 5.0)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2020
- CSCE 3010.1: Signals and Systems (4.1 / 5.0)
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2020
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2019
- CSCE 5933.3: LTE Physical Layer Using MATLAB (4.3 / 5.0)
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2019
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6940.743: Software Defined Radios (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2018
- CSCE 5933.3: LTE Physical Layer Using MATLAB (4.8 / 5.0)
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2018
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6940.743: Jitter-buffer Management and Interference in VoIP (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2017
- CSCE 5933.3: LTE Physical Layer Using MATLAB (4.9 / 5.0)
- CSCE 6940.743: 5G MIMO Systems (no evaluation done)
- CSCE 6940.743: VoLTE and VoWiFi (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2017
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2016
- CSCE 5933.3: LTE Physical Layer Using MATLAB (4.7 / 5.0)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2016
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2015
- CSCE 3010.1: Signals and Systems (5.7 / 7.0)
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2015
- CSCE 5934.743: Directed Study (no evaluation done)
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2014
- CSCE 3010.1: Signals and Systems (3.32 / 4.00)
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)
- CSCE 6590.1: Advanced Topics in Wireless Communications & Networks: 4G/LTE (3.79 / 4.00)

Spring 2014
- CSCE 3510.1: Intro to Wireless Communication (808 – Highly Effective)
- CSCE 5510.1: Wireless Communications (808 – Highly Effective)
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2013
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)
- CSCE 6590.1: Advanced Topics in Wireless Communications & Networks: 4G/LTE (804 – Highly Effective)

Spring 2013
- CSCE 4890.743: Directed Study (no evaluation done)
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6940.743: Individual Research (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Fall 2012
- CSCE 3010.1: Signals and Systems (793 – Highly Effective)
- CSCE 5540.1: Intro to Sensor Networks (814 – Highly Effective)
- CSCE 5950.743: Thesis (no evaluation done)
- CSCE 6950.743: Dissertation (no evaluation done)

Spring 2012
- CSCE 3020.1: Communication Systems (809 – Highly Effective)
- CSCE 3510.1: Intro to Wireless Communication (811 – Highly Effective)
- CSCE 5510.1: Wireless Communications (817 – Highly Effective)
- EENG 3810.1: Communication Systems (801 – Highly Effective)

Fall 2011
- CSCE 3010.1: Signals and Systems (793 – Highly Effective)

- CSCE 5540.1: Intro to Sensor Networks (824 – Highly Effective)

Spring 2011
- CSCE 3020.1: Communication Systems (820 – Highly Effective)
- CSCE 3510.1: Intro to Wireless Communication (812 – Highly Effective)
- CSCE 5510.1: Wireless Communications (812 – Highly Effective)
- EENG 3810.1: Communication Systems (826 – Highly Effective)

Fall 2010
- CSCE 3010.1: Signals and Systems (857 – Highly Effective)
- CSCE 5540.1: Intro to Sensor Networks (831 – Highly Effective)

Spring 2010
- CSCE 3020.1: Communication Systems (792 – Highly Effective)
- CSCE 3510.1: Intro to Wireless Communication (793 – Highly Effective)
- CSCE 5510.1: Wireless Communications (834 – Highly Effective)
- EENG 3810.1: Communication Systems (854 – Highly Effective)

Fall 2009
- CSCE 3010.1: Signals and Systems (4.40 / 5.00)
- CSCE 5540.1: Intro to Sensor Networks (4.70 / 5.00)
- EENG 2620.1: Signals and Systems (4.40 / 5.00)

Spring 2009
- CSCE 3020.1: Communication Systems (4.87 / 5.00)
- CSCE 3510.1: Intro to Wireless Communication (4.65 / 5.00)
- CSCE 5510.1: Wireless Communications (4.79 / 5.00)

Fall 2008
- CSCE 3010.1: Signals and Systems (4.91 / 5.00)
- CSCE 5540.2: Intro to Sensor Networks (4.10 / 5.00)
- EENG 2620.3: Signals and Systems (4.91 / 5.00)

Spring 2008
- CSCE 3020.1: Communication Systems (4.68 / 5.00)
- CSCE 3510.1: Intro to Wireless Communication (3.96 / 5.00)
- CSCE 5510.1: Wireless Communications (4.75 / 5.00)

Fall 2007
- CSCE 3010.1: Signals and Systems (4.57 / 5.00)
- CSCE 5540.2: Intro to Sensor Networks (4.01 /5.00)

Summer 2007
- CSCE 3020.1: Fund. of Communication Theory (no evaluation done)
- EENG 3810.1: Communication Systems (no evaluation done)

Spring 2007
- CSCE 5510.2: Wireless Communications (4.75 / 5.00)
- CSCE 5933.6: Fundamentals of VoIP (4.70 / 5.00)

Fall 2006
- CSCE 3010.1: Signals and Systems (4.58 / 5.00)
- CSCE 5540.1: Intro to Sensor Networks (4.70 / 5.00)
- EENG 2620.1: Signals and Systems (4.58 / 5.00)

Summer 2006

- CSCE 3020.1: Fund. of Communication Theory (no evaluation done)
- CSCE 3510.21: Intro to Wireless Communications (no evaluation done)
- CSCE 5510.21: Intro to Wireless Communications (no evaluation done)
- EENG 3810.1: Communication Systems (no evaluation done)

Spring 2006
- CSCE 2610.2: Computer Organization (3.69 / 5.00)
- CSCE 3010.1: Signals and Systems (4.41 / 5.00)
- EENG 2620.1: Signals and Systems (4.41 / 5.00)

Fall 2005
- CSCE 3510.1: Intro to Wireless Communications (4.52 / 5.00)
- CSCE 5510.1: Wireless Communications (4.46 / 5.00)
- CSCE 5933.6: Intro to Sensor Networks (4.60 / 5.00)

Summer 2005
- CSCE 3010.21: Signals and Systems (no evaluation done)
- CSCE 3510.21: Intro to Wireless Communications (no evaluation done)

Spring 2005
- CSCE 3510.02: Intro to Wireless Communications (4.46 / 5.00)
- CSCI 3100.02: Computer Organization (4.14 / 5.00)

Fall 2004
- CSCE 3510.01: Intro to Wireless Communications (4.15 / 5.00)
- CSCI 4510.01: Machine Structures (4.55 / 5.00)
- CSCI 5330.02: Intro to Wireless Communications (4.05 / 5.00)

Summer 2004
- CSCI 4330.22: Intro to Wireless Communications (no evaluation done)
- CSCI 4330.23: Intro to Wireless Communications (no evaluation done)
- CSCI 5330.22: Intro to Wireless Communications (no evaluation done)

Spring 2004
- CSCI 3100: Computer Organization (4.64 / 5.00)
- CSCI 4330: Intro to Wireless Communications (4.22 / 5.00)

Fall 2003
- CSCI 4510: Machine Structures (4.49 / 5.00)
- CSCI 5330: Intro to Wireless Communications (4.83 / 5.00)

Summer 2003
- CSCI 3100: Computer Organization (no evaluation done)

Spring 2003
- CSCI 3100: Computer Organization (3.84 / 5.00)

Fall 2002
- CSCI 4510: Machine Structures (4.38 / 5.00)

Funded Proposals

R1. "I/UCRC Industrial Membership - Ashum Corp," 2020. Krishna Kavi (PI), Robert Akl (co-PI), **$52,000.**

R2. "I/UCRC Industrial Membership - Ashum Corp," 2019. Krishna Kavi (PI), Robert

Akl (co-PI), **$60,900.**

R3. "I/UCRC Industrial Membership - Ashum Corp," 2018. Krishna Kavi (PI), Robert Akl (co-PI), **$57,700.**

R4. "Robotics and App Design Summer Camp" under Texas Higher Education Coordinating Board: Engineering Summer Program. Requested amount is $11,727. Submitted 5/5/17. Robert Akl (PI), **$11,727.**

R5. "I/UCRC Industrial Membership - Ashum Corp," 2017. Krishna Kavi (PI), Robert Akl (co-PI), **$50,000.**

R6. "UNT GenCyber Summer Program: Inspiring the Next Generation of Cyber Stars in North Texas," National Security Agency (NSA). Requested amount is $85,000. Submitted 11/4/2016. Robert Akl (co-PI), **$85,000**.

R7. "App Design Summer Camp" under Texas Higher Education Coordinating Board: Engineering Summer Program. Requested amount is $12,900. Submitted 5/6/16. Robert Akl (PI), **$12,900.**

R8. "I/UCRC Industrial Membership - Ashum Corp," 2016. Krishna Kavi (PI), Robert Akl (co-PI), **$65,000.**

R9. "Robotics, Game and App Programming Summer Camps" under Texas Workforce Commission: Summer Merit Program. Requested amount is $63,000. Submitted 11/16/15. Robert Akl (PI), **$63,000**.

R10. "App Design Summer Camp" under Texas Higher Education Coordinating Board: Engineering Summer Program. Requested amount is $13,998. Submitted 5/1/15. Robert Akl (PI), **$13,988**.

R11. "I/UCRC Industrial Membership - Ashum Corp," 2015. Krishna Kavi (PI), Robert Akl (co-PI), **$40,000.**

R12. "App Design Summer Camp" under Texas Higher Education Coordinating Board: Engineering Summer Program. Requested amount is $12,500. Submitted 5/2/14. Robert Akl (PI), **$12,500**.

R13. "I/UCRC Industrial Membership - Ashum Corp," 2014. Krishna Kavi (PI), Robert Akl (co-PI), **$46,000.**

R14. "I/UCRC Industrial Membership - Ashum Corp," 2013. Krishna Kavi (PI), Robert Akl (co-PI), **$38,500.**

R15. "Robotics, Game and App Programming Summer Camps" under Texas Workforce Commission: Summer Merit Program. Requested amount is $63,000. Submitted

12/14/12. Robert Akl (PI), **$63,000**.

R16. "Bio-Com Project," funded by Raytheon under Net-Centric Software and Systems I/UCRC 2nd year. Requested amount is $30,000. Submitted 5/12/12. Krishna Kavi (PI), Robert Akl (co-PI), **$30,000.**

R17. "Bio-Com Project," funded by Raytheon under Net-Centric Software and Systems I/UCRC. Requested amount is $30,000. Submitted 5/12/11. Krishna Kavi (PI), Robert Akl (co-PI), **$30,000.**

R18. "Game Programming for Xbox 360 Summer Camp" under Texas Higher Education Coordinating Board: Engineering Summer Program. Requested amount is $20,000. Submitted 3/21/11. Robert Akl (PI), **$20,000**.

R19. "RoboCamps and Game Programming Summer Camps" under Texas Workforce Commission: Summer Merit Program. Requested amount is $63,000. Submitted 2/17/11. Robert Akl (PI), **$63,000**.

R20. "Game Programming for Xbox 360 Summer Camp" under Texas Higher Education Coordinating Board: Engineering Summer Program. Requested amount is $13,000. Submitted 2/22/10. Robert Akl (PI), **$18,000.**

R21. "Robotics and Game Programming Summer Camps" under Texas Workforce Commission: Summer Merit Program. Requested amount is $63,000. Submitted 10/16/09. Robert Akl (PI), **$63,000**.

R22. "Micro Air Vehicle Design: A Collaborative Undergraduate Project for Electrical Engineering, Computer Engineering, and Computer Science Students," under UNT Undergraduate Research Initiative. Submitted 9/25/2009. Robert Akl (co-PI), **$8,000**.

R23. "Summer Merit Program" under Texas Workforce Commission. Requested amount is $42,000. Submitted 3/20/09. Robert Akl (PI), **$42,000**.

R24. "Robocamp at Stewpot" under Dallas Women's Foundation. Requested amount is $20,000. Submitted 2/23/09. Robert Akl (PI), **$18,600**.

R25. "Robocamp Jump Start" under Motorola Foundation Innovation Generation Grant. Requested amount is $29,852. Submitted 2/12/09. Robert Akl (PI), **$30,700**.

R26. "Engineering Summer Program" under Texas Higher Education Coordinating Board. Requested amount is $7,944. Submitted 2/13/09. Robert Akl (PI), **$11,111**.

R27. "Texas Youth in Technology" under Texas Workforce Commission. Requested amount is $152,393. Submitted 11/10/08. Robert Akl (PI), **$152,393**.

R28. "I/UCRC Center Proposal: Net-Centric Software and Systems," under NSF-07-537: Industry/University Cooperative Research Centers. Requested amount is $349,482. Submitted 9/26/08. Krishna Kavi (PI), Robert Akl (co-PI), **$60,000 per year for 5 years**.

R29. "Robocamp and Beyond" under Motorola Foundation Innovation Generation Grant. Requested amount is $30,000. Submitted 6/20/08. Robert Akl (PI), **$30,000**.

R30. Texas Youth in Technology" under Texas Workforce Commission. Requested amount is $30,000. Submitted 2/27/08. Robert Akl (PI), **$31,500**.

R31. "Robocamp Program for Young Women" under RGK foundation. Requested amount is $30,000. Submitted 11/5/07. Robert Akl (PI), **$15,000**.

R32. "Texas Youth in Technology" under Texas Workforce Commission. Requested amount is $102,514. Submitted 10/22/07. Robert Akl (PI), **$102,514**.

R33. "Women Art Technology" under Hispanic and Global Studies Initiatives Fund. Requested amount is $14,125. Submitted 9/30/07. Jennifer Way (PI), Robert Akl (co-PI), **$12,785**.

R34. "Robocamp Mobile Unit" under Motorola Foundation Innovation Generation Grant. Requested amount is $35,000. Submitted 6/20/07. Robert Akl (PI), **$30,000**.

R35. "ICER: UNT Engineering Challenge Camps" under NSF 0547299. Requested amount is $35,000. Submitted 4/27/07. Oscar Garcia (PI), Robert Akl (senior personnel), **$32,792**.

R36. "I/UCRC-Planning Proposal: UNT Research Site Proposal to join Embedded Systems I/UCRC," under NSF-01-116: Industry/University Cooperative Research Centers. Requested amount is $10,000. Submitted 3/31/07. Krishna Kavi (PI), Robert Akl (co-PI), **$10,000**.

R37. "High-assurance NCCS: Ultra Dependability Integration Engineering," Department of Defense. Requested amount is $20,000. Submitted 3/12/07. Krishna Kavi (PI), Robert Akl (co-PI), **$20,000**.

R38. "Recruiting and Retention Strategies for Computer Science at UNT" under Texas Technology Workforce Development Grant Program – 2005. Requested amount is $163,322. Submitted 3/17/05. Robert Akl (PI), **$125,322**.

R39. UNT Faculty Research Grant for Fall 2003, Robert Akl (PI), $5,000, **$4,000**.

R40. UNT Junior Faculty Summer Research Fellowship for Summer 2003, Robert Akl (PI), $5,000, **$5,000**.

Professional Associations and Achievements

Membership in Professional Organizations

- Senior Member IEEE
- Member, Federation Council of North Texas Universities
- Member, Eta Kappa Nu Electrical Engineering Honor Society
- Member, Golden Key National Honor Society
- Member, Tau Beta Pi Engineering Honor Society

Offices and Committee Assignments in Professional Organizations

- Technical Program Committee Member, IEEE Wireless Communications and Networking Conference, IEEE WCNC
- Technical Program Committee Member, International Wireless Symposium, IWS
- Technical Program Committee Member, IEEE International Conference on Computational Science, IEEE ICCS
- Technical Program Committee Member, IASTED International Conference on Wireless Communications, WC
- Technical Program Committee Member, WTS Wireless Telecommunications Symposium
- Technical Program Committee Member, Mosharaka International Conference on Computer Science and Engineering, Amman
- Invitation to serve as an NSF reviewer/panelist for Engineering Research Centers (ERC) proposals
- Technical Program Committee Member, 18th IEEE International Symposium on Personal, Indoor and Mobile Radio Communication, Greece
- International Program Committee, IASTED International Conference on Wireless and Optical Communication, Canada
- Program Committee Member, Fifth Annual Wireless Telecommunications Symposium, CA
- Technical Publications Chair, IEEE Vehicular Technology Conference, Dallas TX
- Session Chair, International Conference on Computing, Commun. and Control Tech., Austin TX
- Session Chair, International Conference on Cybernetics and Information Technologies, Orlando FL
- Session Chair, 8th World Multi Conference on Systemics, Cybernetic, and Informatics, Orlando FL

Additional Responsibilities and Activities

- Reviewer, *Wireless Communications and Mobile Computing*, 2012 – present
- Reviewer, *Journal of Sensor and Actuator Networks*, 2012 – present
- Reviewer, *IEEE Transactions on Vehicular Technology*, 2011 – present
- Reviewer, *Elsevier Journal of Computers & Electrical Engineering*, 2008 – present
- Reviewer, *IEEE Globecom*, 2007 – present
- Reviewer, *IEEE International Conference on Advanced Networks and Telecommunication Systems (ANTS)*, 2008 – present
- Reviewer, *The International Wireless Communications and Mobile Computing Conference*, 2007 – present
- Reviewer, *Journal on Wireless Communications and Networking*, 2007 – present
- Reviewer, *IEEE Transactions on Communications*, 2007 - present
- Reviewer, *International Journal of Communication Systems*, 2007 – present
- Reviewer, *IEEE Communications Magazine*, 2005 – present
- Reviewer, *Journal of Wireless Networks*, 2004 – present
- Reviewer, *IEEE Transactions on Mobile Computing*, 2004 – present
- Reviewer, *IEEE Transactions on Wireless Communications*, 2004 – present
- Reviewer, *ACM Crossroads*, 2004 – present

Honors and Awards

- Who's Who in America, 2012 Edition
- Winner of Tech Titan of the Future – University Level Award for UNT Robocamps for Girls, Metroplex Technology Business Council, 2010 with **$15,000 cash prize**.
- IEEE Professionalism Award, Ft Worth Chapter, 2008
- UNT College of Engineering Outstanding Teacher Award, 2008
- Certificate of Appreciation: IEEE Vehicular Technology Conference, Dallas, TX, 2005
- Certificate of Appreciation: Denton County Boosting Engineering, Science and Technology (BEST) Robotics Competition, 2004
- Summa Cum Laude Graduate, Ranked First in Undergraduate Class
- The Computer Science Departmental Award for Academic Excellence, Washington University, 1993
- The Dual Degree Engineering Award for Outstanding Senior, Washington University, 1993
- The 1992 Technical Writing Competition Award, The Society for Technical Communication