

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Title: DISPLAY APPARATUS AND VIDEO PROCESSING
 APPARATUS

DECLARATION OF R. MICHAEL BUEHRER

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I, R. Michael Buehrer, of Blacksburg, Virginia, declare that:

I. INTRODUCTION

1. My name is R. Michael Buehrer and I have been retained as an expert witness by LG Electronics and LG Electronics USA in petition for *inter partes review* challenging claims of U.S. Patent No. 10,244,284 B2 (the '284 Patent).

2. I have been asked to provide my independent analysis of the '284 Patent in light of the prior art publications cited in this Declaration.

3. I am not and never have been an employee of LG. I received no compensation for this Declaration beyond my normal hourly compensation based on my time actually spent analyzing the '284 Patent, the prior art publications cited below, and issues related thereto, and I will not receive any added compensation based on the outcome of any IPR or other proceeding involving the '284 Patent.

4. 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 in this Declaration.

5. 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 consider additional documents and information in forming any necessary opinions, including documents that may not yet have been provided to me.

6. 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 already provided.

7. In writing this Declaration, I have considered my own knowledge and experience, including my work experience in the field of wireless and digital data communications and my experience in working with others involved in this field. Moreover, I have considered my knowledge and experience derived from serving on standards committees and organizing technology-based conferences, including those organized by the Institute of Electrical and Electronics Engineers (IEEE).

8. In addition, I have analyzed the following publications and materials, in addition to other materials I cite in my declaration:

- U.S. Patent No 10,244,284 (LG-1001), and its accompanying prosecution history (LG-1002)
- US. Pat. App. Pub. No. 2006/0135076A1 (“Honkanen”) (LG-1004)
- Nokia N95-1 User Guide (“N95”) (LG-1005)
- US. Pat. App. Pub. No. 2006/0258289 (“Dua”) (LG-1006)
- US. Pat. App. Pub. No. 2005/0136949A1 (“Barnes”) (LG-1007)

- Complaint, *Maxell, Ltd. v. LG Electronics Inc. et al*, 5-23-cv-00152, E.D. Tex., filed December 29, 2023 (LG-1008)
- Declaration and Curriculum Vitae of June Ann Munford (LG-1009)
- Nokia N93 User Guide (“N93”) (LG-1010)
- Specification of the Bluetooth System (“Bluetooth-Specification”) (LG-1011)
- Appendix 4 of Maxell’s Infringement Contentions, 5:24-cv-04972-EKL, N.D.Cal., filed December 18, 2024 (LG-1012)
- US. Pat. App. Pub. No. 2006/0203758A1 (“Tee”) (LG-1013)
- US. Pat. App. Pub. No. 2004/0125779A1 (“Kelton”) (LG-1014)
- District Court Claim Construction Order for US11,445,241B2, *Maxell LTD. v. Samsung Electronics Co. et al*, 5:23-CV-00092-RWS (LG-1015)
- IEEE 802.11g (LG-1016)
- US. Pat. App. Pub. No. 2004/0264600A1 (“Kao”) (LG-1017)
- R. Malyan and A Lenaghan, *A Multi-service Architecture to Support Mobile IP Applications over Heterogeneous Wireless Networks*, Eurocon, 313 (2003) (LG-1018)

9. IEEE 802.11g is a standard for telecommunications and information exchange in wireless (WLAN). I am familiar with both this standard and its

publisher IEEE (of which I am a member). I have taught short courses on 802.11 standards and also incorporated these standards into courses that I teach at Virginia Tech. IEEE 802.11g would have been available to and disseminated to members of the general technical community at least as of June 27, 2003. LG-1016.

II. QUALIFICATIONS AND BACKGROUND INFORMATION

10. I earned a B.S. and M.S. in Electrical Engineering from the University of Toledo in 1991 and 1993, respectively, and a Ph.D in Electrical Engineering from Virginia Polytechnic Institute and State University in 1996.

11. I am currently a Professor in the Bradley Department of Electrical and Computer Engineering at Virginia Polytechnic Institute and State University (also known as “the Virginia Tech”). I held the position of Director of *Wireless @ Virginia Tech* a research group comprised of 12 faculty members and nearly 100 graduate students at Virginia Tech that focuses on conducting research to advance the fields wireless communications, radar and geolocation. I worked in the *Mobile and Portable Radio Research Group* from August 2001 to August 2005. This research group expanded and became *Wireless @ Virginia Tech* in 2005. I have been a member of that group since its inception and served as the director from 2014-2022.

12. Prior being promoted to Professor of Electrical and Computer Engineering at Virginia Tech in 2012, I was an Associate Professor at Virginia

Tech from August 2006 to August 2012, a Visiting Researcher at the Laboratory for Telecommunication Sciences (LTS) from August 2009 to December 2009, and an Assistant Professor at Virginia Tech from August 2001 to August 2006. I have supervised over 60 Ph.D. and M.S. graduate students to the completion of their degrees and a number of undergraduate students during the course of my career. Prior to that, I worked as a Member of Technical Staff at Bell Laboratories from August 1996 to August 2001, and was promoted to Distinguished Member of Technical Staff in 1999.

13. My area of expertise is wireless communications, radar and geolocation including general digital data transmission such cellular networks, nearfield communications, and local wireless networks. As such, I regularly teach undergraduate and graduate students taking courses from the level of sophomore to Ph.D. I regularly teach a sophomore level course on Signals and Systems, a junior level course titled Introduction to Communication Systems, a senior level course on digital communications, and two graduate level courses on digital communications and multi-channel communications. I have also taught courses on spread spectrum communications, information theory and machine learning applied to communications.

14. I have received numerous awards for research and teaching, including the Military Communications (MILCOM) Lifetime Award for Technical

Achievement (2023), National Spectrum Consortium (NSC) Vanu Bose Best Paper Award at IEEE MILCOM (2023 and 2021), the Fred W. Ellersick Award for the Best Paper in the Unclassified Technical Program at IEEE MILCOM (2023 and 2010), the Dean's Award for Teaching at Virginia Tech, the Dean's Award for Outstanding New Professor, and the Bell Lab President's Silver Award for outstanding research contributions.

15. I have published over 300 articles in top conferences and journals in the areas of wireless communications and antennas. Many of my results are highly cited, and I have received multiple "Best Paper" Awards. My research has been cited over 13,000 times. I have also written more than fifteen books or book chapters in the field of wireless communications and geolocation,.

16. I am a Fellow at the Institute of Electrical and Electronics Engineers (IEEE), so recognized due to my work in wideband wireless communications and geolocation. I am a member of multiple IEEE societies including Communications Society, Vehicular Technologies Society, and Signal Processing Society.

17. I was an organizer for the IEEE DySPAN 2024 Conference. I served as the Technical Program Chair for the Signal Processing for Communications Symposium at the 2017 IEEE International Conference on Communications. I also recently served as the Technical Program Chair at the IEEE Vehicular Technology Conference (2024) and also as the Special Session co-Chair for the 2023 IEEE

Radar Conference. I have also served on the technical program committees of several other conferences and workshops in my field.

18. I have served as Area Editor for *IEEE Transactions on Wireless Communications* (2017 – 2022), Guest Lead Editor for *IEEE Journal on Special Topics in Signal Processing*, and Associate Editor in several other IEEE journals, including *IEEE Wireless Communications Letters* (2010 – 2014), *IEEE Transactions on Communications* (2009 – 2014), *IEEE Transactions on Wireless Communications* (2005 – 2012, 2015 – 2017, *IEEE Transactions on Vehicular Technologies* (2005 – 2009).

19. I am a named inventor on eighteen US patents. These patents are in the field of wireless communications and geolocation. Among others, the patents provide details for estimating the location of a wireless terminal based on its radio-frequency, methods for diversifying transmissions, transmission channel estimation and compensation based thereon, cellular communication systems.

20. My curriculum vitae, included with this declaration, includes a list of publications on which I am a named author. It contains further details regarding my experience, education, publications, and other qualifications to render an expert opinion in connection with this proceeding.

21. In writing this Declaration, I have considered the following: my own knowledge and experience, including my work experience in the fields of wireless

digital data communication; my experience in teaching those subjects; and my experience in working with others involved in those fields.

III. LEGAL PRINCIPLES

22. I am not a lawyer and I will not provide any legal opinions in this IPR. Although I am not a lawyer, 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.

A. Anticipation

23. I have been informed that a patent claim is invalid as anticipated under pre-AIA 35 U.S.C. §102 if each and every element of a claim, as properly construed, is found either explicitly or inherently in a single prior art reference. Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes the claimed limitations, it anticipates.

24. I have been informed that a claim is invalid under pre-AIA 35 U.S.C. §102(a) if the claimed invention was known or used by others in the U.S., or was patented or published anywhere, before the date of applicant's invention. I further have been informed that a claim is invalid under pre-AIA 35 U.S.C. §102(b) if the invention was patented or published anywhere, or was in public use, on sale, or offered for sale in this country, more than one year prior to the filing date of the patent application. And a claim is invalid, as I have been informed, under pre-AIA

35 U.S.C. §102(e), if an invention described by that claim was described in a U.S. patent granted on an application for a patent by another that was filed in the U.S. before the invention date of that claim.

B. Obviousness

25. I understand that a patent claim is invalid if the claimed invention would have been obvious under pre-AIA 35 U.S.C. §103 to a POSITA. Thus, even if all of the claim limitations are not found in a single prior art reference that anticipates the claim, the claim can still be invalid.

26. I have been informed that a patent claim is invalid as obvious in light of one or more prior art references if it would have been obvious to a POSITA, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any so called “secondary considerations” of non-obviousness, which include: (i) “long felt need” for the claimed invention, (ii) commercial success attributable to the claimed invention, (iii) unexpected results of the claimed invention, and (iv) “copying” of the claimed invention by others. For purposes of my analysis , I have applied a date of November 28, 2007—the Critical Date—as the invention date in my obviousness analyses, although, as explained above, in many cases the same analysis would hold true even at an earlier time than the Critical Date.

27. I have been informed that a claim can be obvious in light of a single prior art reference or multiple prior art references. To be obvious in light of a single prior art reference or multiple prior art references, there must be a reason to modify the single prior art reference, or combine two or more references, in order to achieve the claimed invention. This reason may come from a teaching, suggestion, or motivation to combine, or may come from the reference or references themselves, the knowledge or “common sense” of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole. I have been informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand it is improper to rely on hindsight in making the obviousness determination.

28. I have been informed by Counsel and understand that if a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond their skill.

29. I have been informed by Counsel and understand that practical and common sense considerations should guide a proper obviousness analysis, because familiar items may have obvious uses beyond their primary purposes. I have been informed by Counsel and understand that a POSITA looking to overcome a

problem will often be able to fit together the teachings of multiple prior art references. I have been informed by Counsel and understand that obviousness analysis therefore takes into account the inferences and creative steps that a POSITA would have employed.

30. I have been informed by Counsel and understand that a proper obviousness analysis focuses on what was known or obvious to a POSITA, not just the patentee. Accordingly, I understand that 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.

31. I have been informed by Counsel and understand that a claim can be obvious in light of a single reference, without the need to combine references, if the elements of the claim that are not found explicitly or inherently in the reference can be supplied by the common sense of a POSITA.

IV. SUMMARY OF CONCLUSIONS FORMED

32. This Declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions:

- **Ground 1:** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 18-20 of the '284 Patent are rendered obvious by Honkanen in view of N95.

- **Ground 1A:** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 19 and 20 of the '284 Patent are rendered obvious by Honkanen in view of N95 and in further view of Bluetooth-Specification and IEEE 802.11g.
- **Ground 2:** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 18-20 of the '284 Patent are rendered obvious by Dua in view of Barnes.
- **Ground 2A:** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 18-20 of the '284 Patent are rendered obvious by Dua in view of Barnes and in further view of N95.
- **Ground 2B:** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 19 and 20 of the '284 Patent are rendered obvious by Dua in view of Barnes and in further view of Kao.
- **Ground 2C:** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 19 and 20 of the '284 Patent are rendered obvious by Dua in view of Barnes and in further view of Kao and Bluetooth-Specification.

- **Ground 2C(a):** Based upon my knowledge and experience and my review of the prior art publications listed above, I believe that claims 19 and 20 of the '284 Patent are rendered obvious by Dua in view of Barnes and N95 and in further view of Kao and Bluetooth-Specification

V. BACKGROUND KNOWLEDGE ONE OF SKILL IN THE ART WOULD HAVE HAD PRIOR TO THE CRITICAL DATE OF THE '284 PATENT

33. Based on the foregoing and upon my experience in this area, a person of ordinary skill in the art ("POSITA") relating to the subject matter of the '284 Patent as of November 28, 2007 ("Critical Date") would have had (1) a Bachelor's Degree (or a similar Master's Degree, or higher degree) in electrical engineering, computer engineering, computer science, or a related field, and (2) one to two years of practical experience in the field of wireless digital data communication, wireless digital video transmission, or a related field. Additional education or industry experience may compensate for a deficit in one of the other aspects of the requirements stated above.

34. Based on my experience, I have a good understanding of the capabilities of a POSITA as I possessed and exceeded the qualifications of a POSITA at the time of the Critical Date. Moreover, I have taught, participated in

organizations with, and worked closely with many such persons over the course of my career.

VI. TECHNOLOGY BACKGROUND

35. The technology in the ‘284 Patent generally relates to “establish[ing] connections between a plurality of apparatuses and networks by radio.” LG-1001, 1:17-20. The Patent discloses a multi-radio device capable of connecting to multiple external devices and networks at the same time.

36. Prior to the critical date of the ‘284 patent, there existed numerous products, publications, and patents that implemented or described the functionality claimed in the ‘284 patent. Thus, the methodology of the ‘284 patent was well-known in the prior art. Further, to the extent there was any problem to be solved in the ‘284 patent, it had already been solved in the prior art systems before the critical date of the ‘284 patent.

37. As further explain in this Declaration, by the critical date of the ‘284 Patent, users were interested in using a single device (e.g., their mobile phones) to benefit from different wireless communications technologies to communicate with more than one external system. And the users’ interest motivated the wireless industry to invest in such technologies.

38. Instant (or “live”) data forwarding was one of the example applications of using multiple wireless protocols on a single device. *See e.g.*,

LG1007, ¶¶60-63. A device capable of instant data forwarding was able to download a digital file (e.g., a video clip, an image, an audio, etc.) from a data source, and forward or broadcast the digital file to one or more secondary devices. This configuration allowed the users to benefit from using several devices (for example, in their local network) without each and every one of those secondary devices having to be connected to the data source. This could save costs for the user specially before the critical date of the '284 Patent. The data sharing feature gave the users the benefit of paying for only a single event of data reception (e.g., downloading) from the data source, but using the same data on multiple devices.

39. As another benefit, the user could receive cellular data and transmit that data to a secondary device that would present the data in a higher quality than the user's receiving device would. For example, if the data was a video clip, the user could receive (e.g., download) the video clip from the internet via a cellular network and transfer it to a television (while simultaneously maintaining a connection with the internet) so that the user could benefit from watching the video clip live without the television needing to be connected to the cellular network (or the internet). Similarly, the user could receive audio data from a cellular network, and transmit that data to a sound system with higher quality than the receiving device, so that the user could listen to the audio while maintaining a connection with the internet.

40. Another benefit of such multi-connection devices was data sharing. Users could share the received data with a friend so that the two could use (e.g., watch, listen to) the received data, for example, at the same time. By the critical date, data sharing was a well-recognized benefit of wireless communication technology, and there were a variety of techniques to achieve it, including using one recipient user device that would share the received (e.g., downloaded) data with secondary (e.g., friends or family) devices.

41. The user device could also transmit the data to multiple friend devices so that a group of friends could enjoy using the data (e.g., watching the video) together regardless of where those friends were located at. Having multiple communication technologies collectively installed on the same user device allowed the user to transmit the data to multiple friends regardless of where the friend is located. For example, the user could use Bluetooth to send the data to a first friend sitting next to the user, use WLAN to send data to another friend located in the same building as the user, and yet use cellular network to send the data to another friend living in another city.

42. All these known benefits had motivated the industry to invest on the relevant technologies. Indeed, devices and protocols related to multi-channel communications had long existed before the critical date of the '284 Patent. In 2007, cellular phones with video reception and transmission capabilities, multiple

digital radios, and processors were already a mature technology. For example, Apple's iPhone was announced January 2007 and released in June 2007. Nokia's N93 (LG-1010) and N95 (LG-1005) contained a) multiple radio communication circuits for GSM/GPRS/EDGE, UMTS, Bluetooth, and Wi-Fi, b) camera with microphone for taking pictures and recording videos with sound, c) memory to store media, d) a display to display media and e) a controller TI OMAP processor. Other example devices include HTC TyTN that contained a) multiple radio communication circuits for GSM 850/900/1800/1900, HSDPA 2100/850/1900, Wi-Fi 802.11b/g, and Bluetooth 2.0, b) a camera with imaging circuits for video and still photographs, c) ROM and RAM memory, and d) a 40 Mhz Samsung processor. *See*

https://web.archive.org/web/20060825214705/http://www.gsmarena.com/htc_tytn-1659.php. As another example, the Samsung i600 contained a) multiple radio communication circuits for HSDPA, GSM 900, GSM 1800, GSM 1900, Bluetooth v2.0, WiFi b/g, b) a camera with imaging circuits for video and still photographs, c) compression circuitry for standard compression schemes, d) ROM and RAM memory, and e) a controller TI OMAP processor. *See* https://web.archive.org/web/20071011003138/http://www.gsmarena.com/samsung_i600-1807.php. There are just a few examples of phones with such conventional

hardware, including multiple digital radios. And the ability to receive and transmit video information.

VII. INTERPRETATIONS OF THE ‘284 PATENT CLAIMS AT ISSUE

43. I understand that claim terms are generally given their plain and ordinary meaning in light of the patent’s specification and file history as understood by a POSITA as of the invention date. In that regard, I understand that the best indicator of claim meaning is its usage in the context of the patent specification as understood by a POSITA. I further understand that the words of the claims should be given their plain and ordinary meaning unless that meaning is inconsistent with the patent specification or the patent’s history of examination before the U.S. Patent and Trademark Office (Office). I also understand that the words of the claims should be interpreted as they would have been interpreted by a POSITA at the invention date.

A. Claim Construction – Assignment

44. I have been asked to provide my interpretation of the phrase “assignment between” a communication circuit and an external apparatus or network, as it appears in claim 18 of the ‘284 patent. Claims 18 (in part) recites: *“controlling assignment between the first radio communication circuit and the external apparatus, and assignment between the second radio communication circuit and the internet or the home network.”*

45. The '284 specification does not provide a definition for an “*assignment between* [a] radio communication circuit and [an] external apparatus,” or an “*assignment between* [a] radio communication circuit and the internet or [a] home network.” But based on the disclosure of the '284 Patent, an ***assignment between*** a radio communication circuit and an external apparatus or network in light of the remainder of the claim which narrows the meaning as “controlling the assignment such that the assignment between the first radio communication circuit and the external apparatus is more than the assignment between the second radio communication circuit and the internet or the home network,” means ***assigning particular connection parameter(s)*** to the connection *formed between* the communication circuit and the external apparatus or network; and examples of such connection parameters include transmission rate/capacity, bandwidth, modulation scheme, and transmission schedule (i.e., transmission priority). LG-1001, 2:13-15 (“The control unit ***assigns connection*** of the first radio communication unit ***with higher priority*** and controls the ***assignment of the transmission rate.***”); *id.*, 8:35-47 (“The controller 132 ***and the transmission rate assignment controller*** 1001 may variably control ***the radio transmission assignment to the modems 1002 and 1003*** in response to an indication from the user. For example, in a situation wherein the user issues an indication to transmit video information by radio via the modem 1002 to the display apparatus 200 while

acquiring information from the Internet according to scheme 1 of FIG. 9 by use of the modem 1003, the controller 132 *outputs a control signal to the assignment controller 1001 such that the transmission scheme of the modem 1003 is changed from scheme 1 to scheme 2* of FIG. 9 and that of the modem 1002 is set to scheme 1 of FIG. 9 conduct communications.”); *id.*, FIG. 9 (where each of schemes 1 and 2 is associated with a respective *bandwidth, modulation scheme, transmission capacity*, etc.); *id.*, 11:52-56 (“In the operation, the controller 2013 controls the *transmission rate assignment* controller 2017 to vary the transmission rate of the radio modem 2015 in association with the transmission rate of the video information received from the video processing apparatus 100.”); *id.*, 13:7-16 (“in a situation wherein the user issues an indication to receive video information by radio via the modem 2015 from the video processing apparatus 100 while acquiring information from the Internet according to scheme 1 of FIG. 9 by use of the modem 2016, the controller 2013 outputs *a control signal to the assignment controller 2017 such that the transmission scheme of the modem 2016 is changed from scheme 1 to scheme 2 of FIG. 9 and that of the modem 2015 is set to scheme 1 of FIG. 9*).

46. Based on the foregoing, I interpret the phrase assignment between [a] radio communication circuit and an external apparatus or network in light of the required limitation of controlling the assignment such that the assignment between

the first radio communication circuit and the external apparatus is more than the assignment between the second radio communication circuit and the internet or the home network (as recited in claim 18) as **assigning particular connection parameter(s) (such as bandwidth, modulation scheme, transmission capacity/schedule) to the connection formed between the communication circuit and the external apparatus or network.** Based upon my knowledge and experience in this field, I believe that a POSITA would have understood that this interpretation is consistent with the plain meaning of this term under the broadest reasonable interpretation and is consistent with the '284 patent specification.

B. Claim Construction – User Indication

47. Claim 18 recites: “controlling the assignment ... *when a user issues an indication* to transmit digital video information by the first radio communication circuit while acquiring information from the internet or the home network by the second radio communication circuit.

48. While the '284 Specification is not explicit on the content of the user indication, the user indicates two things: (1) to transmit video information, and (2) to use the first radio communication circuit for such transmission. LG-1001, 8:35-47 (“The controller 132 and the transmission rate assignment controller 1001 may variably control the radio transmission assignment to the modems 1002 and 1003 in response to an indication from the user. For example, in a situation wherein the

user issues an indication to transmit video information by radio via the modem 1002 to the display apparatus 200 while acquiring information from the Internet according to scheme 1 of FIG. 9 by use of the modem 1003, the controller 132 outputs a control signal to the assignment controller 1001 such that the transmission scheme of the modem 1003 is changed from scheme 1 to scheme 2 of FIG. 9 and that of the modem 1002 is set to scheme 1 of FIG. 9 conduct communications.”); *id.*, 13:4-16 (providing a similar discussion).

49. This is in line with how the District Court construed a similar language in a child of the '284 Patent. LG-1015, 23 (in construing the claim language “*when an indication from [the/a] user indicates to transmit video information using the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for transmitting the video*” in the child Patent 11,445,241, the Court found that the “language plainly requires the user to indicate two things: (1) to transmit video information, and (2) to use the first radio communication circuit in making that transmission.”).

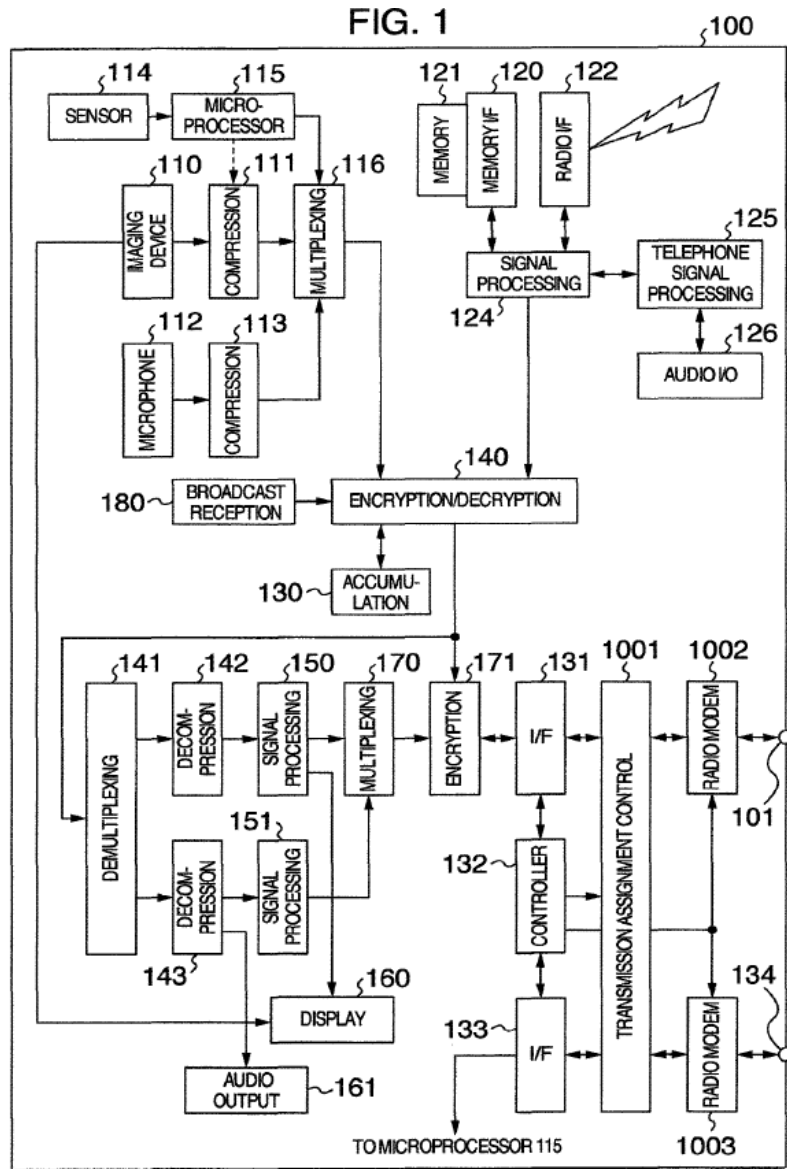
VIII. OVERVIEW OF THE '284 PATENT

A. Description of the '284 Patent

50. The '284 Patent is directed “to a technique to establish connections between a plurality of apparatuses and networks by radio.” LG-1001, 1:17-20. The patent discloses a video processing apparatus 100 that includes “a first radio

communication unit capable of transmitting video information by radio to an external display apparatus, a second radio communication unit capable of connecting by radio to a network, and a connection assignment control unit for controlling assignment of connection by radio transmission for each of the first and second radio communication units.” *Id.*, 2:6-13. “The control unit *assigns connection* of the first radio communication unit with higher priority and controls the assignment of the transmission rate, for example, such that the transmission rate between the first radio communication unit and the external video display apparatus is *more than* the transmission rate between the second radio communication unit and the network.” *Id.*, 2:13-19 (emphasis added). “Therefore, it is possible that video information of high picture quality is continuously fed from the video processing apparatus to the [external display] apparatus.” *Id.*, 2:36-40.

51. Components of an example video processing apparatus 100 are shown in FIG. 1, where the assignments to the modems 1002 and 1003 are controlled as explained above. LG-1001, 3:48-50.



LG-1001, FIG. 1

52. “For example, in a situation wherein the user issues an indication to transmit video information by radio via the modem 1002 to the display apparatus 200 while acquiring information from the Internet according to scheme 1 of FIG. 9 by use of the modem 1003,” the assignment is controlled “such that the transmission scheme of the modem 1003 is changed from scheme 1 to scheme 2 of

FIG. 9[,] and that of the modem 1002 is set to scheme 1 of FIG. 9 [to] conduct communications.” *Id.*, 8:35-47.

SCHEME	SCHEME 1	SCHEME 2
BANDWIDTH	6MHz	6MHz
CARRIER MODULATION SCHEME	64QAM	QPSK
CONVOLUTION CODE	3/4	2/3
GUARD INTERVAL	1/8	1/8
TRANSMISSION CAPACITY	17Mbps	5Mbps

LG-1001, FIG. 9

B. Prosecution History

53. Patent Owner filed Application 15/891,085 on February 7, 2018. LG-1002, 227-228. The Application received one rejection on April 19, 2018, rejecting all claims under §103. *Id.*, 98-110. In response, Applicant added the limitation “when a user issues an indication to transmit digital video information by the first radio communication circuit while acquiring information from the internet or the home network by the second radio communication circuit” at the end of independent claim 18. *Id.*, 69-75.

54. Applicant argued that in the cited art, “[t]he wireless network transceiver and the wireless telephone transceiver respectively connect to different objects,” or “[t]he WLAN circuit and Bluetooth circuit do not connect to the same external video processing apparatus, and do not communicate with the same

apparatus.” *Id.*, 82. “In contrast, in Applicant’s disclosure, two radio communication units connect to the same apparatus.” *Id.*

55. Contrary to the Applicant’s assertion, the claims do not require the radio communication circuits to “connect to the same apparatus,” and I do not believe this limitation can be imported into the claims. Indeed, the Specification of the ’284 Patent is not limited to such a configuration. The Specification discloses a scenario where “a higher transmission rate is assigned *to the communication [between]* the video processing apparatus 100” and a particular external display apparatus 200 than to a network communication. LG-1001, 12:43-67 (emphasis added). Had both radio communication circuits connected “to the same apparatus” (as Applicant asserted), assigning a higher transmission rate to the connection between the two apparatus (as disclosed in the Specification) would have no meaning. Therefore, the specification is broader than requiring the two communication circuits to connect the same device through different channels of communications, and the claims cannot be limited to such a configuration absent explicit recitation of the limitation.

56. The 15/891,085 Application received a Notice of Allowance and was issued as the ’284 Patent on March 3, 2019. LG-1002, 6.

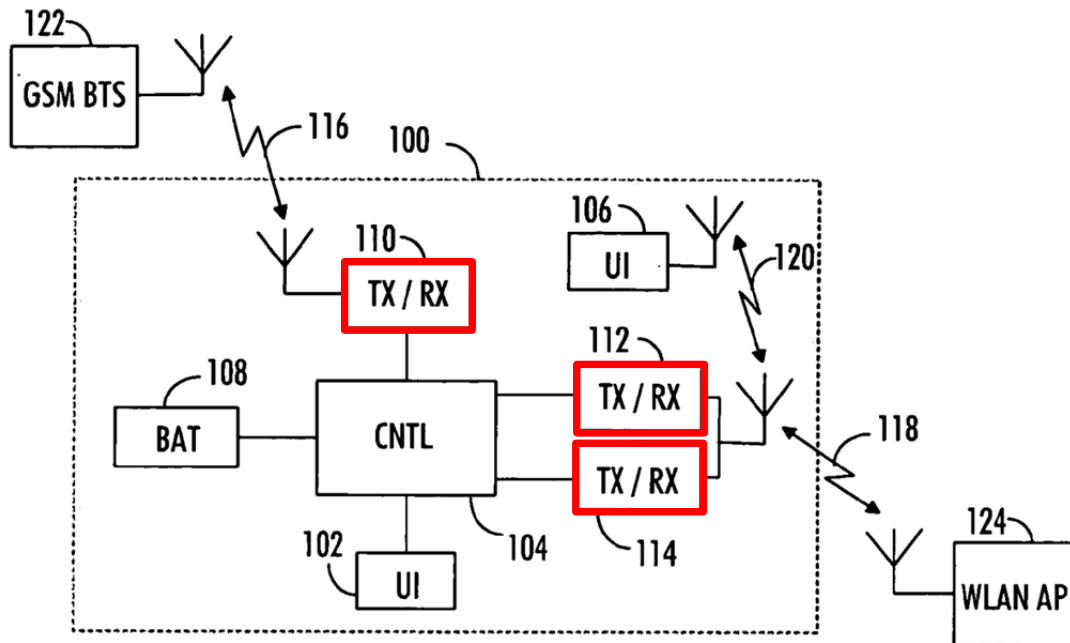
57. Subsequently, Applicant filed a request for Certificate of Correction to insert “prioritized” to the last step of claim 18 so that the step reads as: “controlling

the assignment such that the assignment between the first radio communication circuit and the external apparatus is prioritized more than the assignment between the second radio communication circuit and the internet or the home network.” *Id.*, 2-4. This request was granted without any examination (*Id.*, 1) and I am not providing any comment with respect to the appropriateness of that grant.

IX. SUMMARY OF PRIOR ART

A. Honkanen (LG-1004)

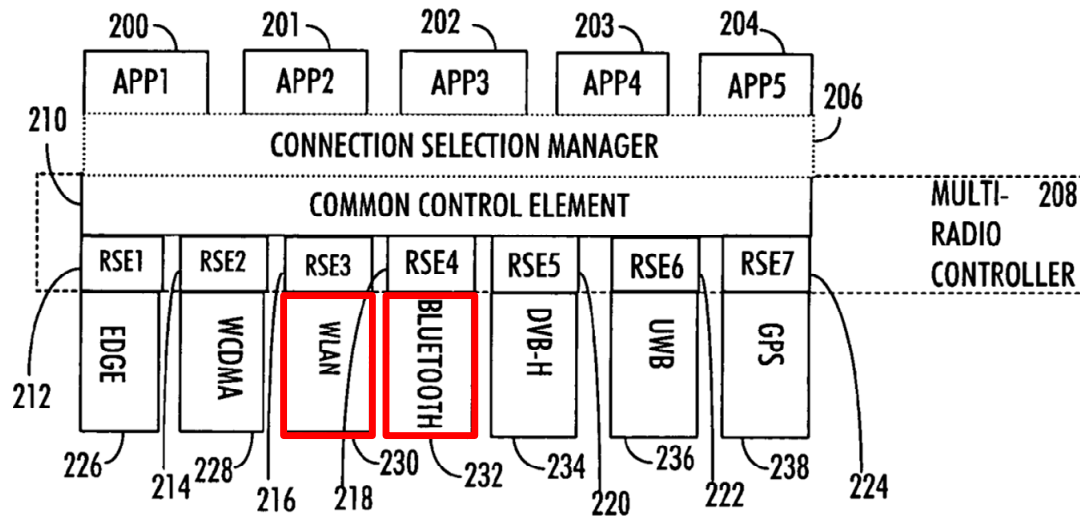
58. Honkanen describes “controlling a number of simultaneous radio connections in a communication device.” LG-1004, ¶¶1, 5. The communication device 100 includes a “control unit 104” that is designed to “control[] a number of simultaneous radio connections.” *Id.*, ¶26; *see* FIG. 1 (reproduced below). Communication device 100 has multiple communication interfaces 110, 112, 114 to make respective radio connections 116, 118, and 120. *Id.*, ¶24.



LG-1004, FIG. 1 (annotated)

59. Each of the communication interfaces has “its own components” such as antenna, radio frequency amplifier, radio frequency filter, and provides connections based on a respective technology. *Id.*, ¶¶24, 25. The technologies include Bluetooth, Wireless Local Area Network (WLAN), Digital Video Broadcasting for Handheld devices (DVB-H), Global System for Mobile Communications (GSM), etc. *Id.*, ¶25. For example, communication interface 112 provides a Bluetooth connection 120 to a user interface 106, and communication interface 114 provides a WLAN connection 118 with a serving access point 124. *Id.*, ¶¶22-25.

60. FIG. 2 depicts an example architecture for the communication device 100, where applications 200-204 are in communication with lower layers 206, 208 to start radio connections. *Id.*, ¶¶30-33.



LG-1004, FIG. 2 (annotated)

61. “Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection.” *Id.*, ¶30. Multi-radio controller 208 (as a lower layer), has a common control element 210 that receives the radio connection request, checks the availability of the requested connection, and controls “simultaneous operation of multiple radio connections.” *Id.*, ¶34. Multi-radio controller 208 also includes radio specific entities 212-224, where each is “an interface between the common control element 210 [and the respective] specific radio interface[s].” Radio interfaces 230 and 232 are depicted in FIG. 2 as WLAN

and Bluetooth interfaces, respectively, which were described earlier as radio interfaces 114 and 112 with respect to FIG. 1. *See id.*, ¶36 (“Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.”).

62. The common control element 210 controls *simultaneous* radio connections by reducing interference between connections. *Id.*, ¶44; *see also id.*, ¶37 (explaining that FIG. 3 shows the “structure of the common control element 210.”). After receiving a connection request from an application, the common control element 210 “first check[s] whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use.” *Id.*, ¶45; *see also id.* (“These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array.”). “If an operational radio connection exists that uses the same radio

resource(s) as the requested new connection,” the common control element 210 “define[s] the parameters for the new connection” or “adjust[s] the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).” *Id.*, [47]; *see also id.*, ¶55 (“The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection.”).

63. Honkanen provides several techniques to minimize interference between two connections that use the same radio resources. *Id.*, ¶¶49-53. These techniques include restricting the overlapping frequencies to only one of the connections, scheduling the two connections to avoid simultaneous data transportations, and “adjusting other parameters of the connections” such as “modulation, coding[,] data rate.” *Id.*

B. N95 (LG-1005)

64. N95 is the user manual of Nokia N95-1 device (referred to as “N95 device” herein). LG-1005, 10¹. N95 device is capable of transferring/receiving digital content to/from external devices and networks. *Id.*, 11-12; *see also id.*, 13 (depicting graphical user interface indicators for different radio connections on the N95 device).

¹ The citations are to the page numbers of the LG-1005 PDF document.



LG-1005, 70 (showing an overview of the N95 device)

C. Bluetooth-Specification (LG-1011)

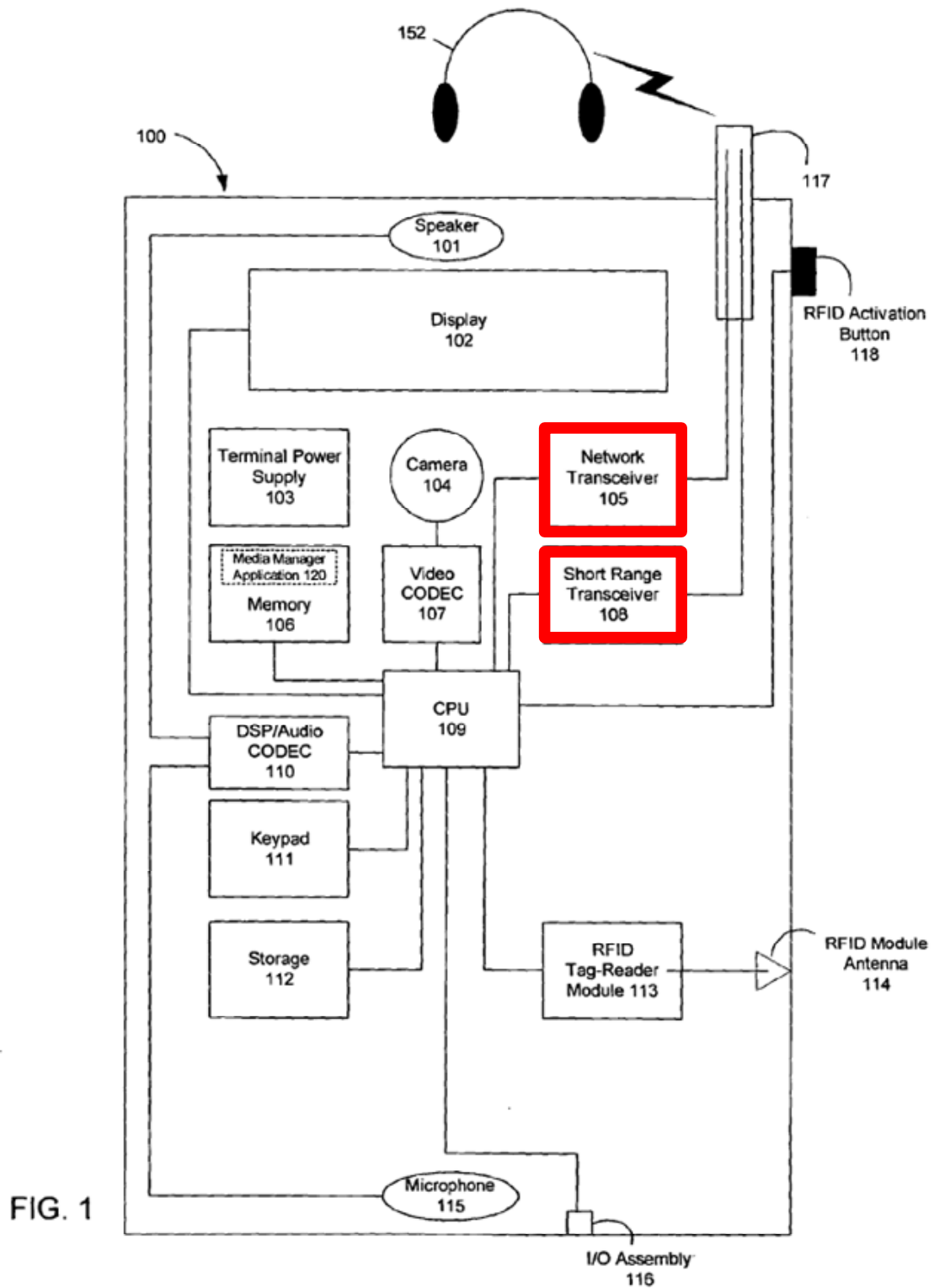
65. Bluetooth-Specification is the description of the well-known short-range wireless standard set for Bluetooth communications. It “is the primary reference document for the Bluetooth Qualification Program and defines its requirements, functions, and policies.” LG-1011, 43.

D. IEEE 802.11g (LG-1016)

66. IEEE-802.11g is a well-known standard for “telecommunications and information exchange between systems” through “local and metropolitan area networks.” LG-1016, 1, 4. This set of standards is generally used in Wireless Local Area Networks (WLAN) often used in office or home networks where the range between devices is generally larger than Bluetooth connections (often termed Wireless Personal Area Networks or WPANs). The range is, however, typically smaller than cellular networks.

E. Dua (LG-1006)

67. Dua discloses a media player 100 that has two separate transceivers: a short range transceiver 108 and a network transceiver 105. LG-1006, ¶61.

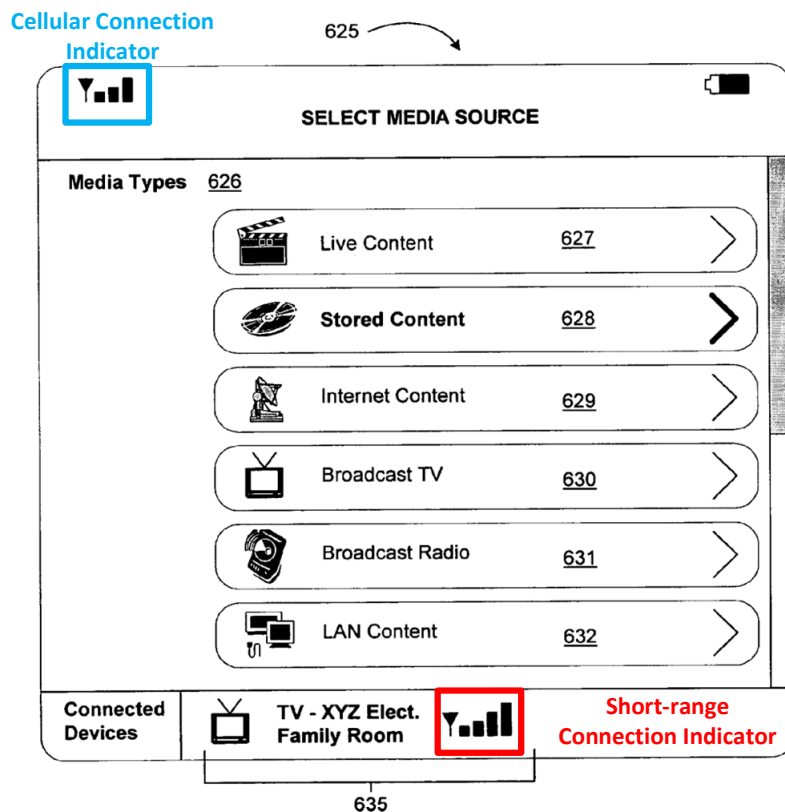


LG-1006, FIG. 1 (annotated)

68. The media player 100 uses its short range transceiver 108 for exchanging messages with external devices within a RF range of the media player, e.g., through Bluetooth, WiFi, etc. LG-1006, ¶62. The media player 100 uses its network transceiver 105 “for interacting with cellular network.” *Id.*, ¶66. “Media player 100 is able to access the Internet through [either of] the cellular network [or] a wireless access point using short range transceiver 108.” *Id.*

69. The media player 100 can use its two transceivers, for example, to simultaneously connect to a cellular network (though transceiver 105) and communicate with a local device in the vicinity of the media player (through transceiver 108). For example, the media player 100 can connect to the cellular network (e.g., to receive Internet content such as news, movies, etc.) and simultaneously transmit a media file (e.g., content received from the Internet, content stored on the media player, etc.) to an external device through a short-range communication. *Id.*; *see also* LG-1006, ¶168 (“The ‘Internet content’ option could, for example, allow a user to browse movie trailers on his wireless media player 100, select a movie for download, pay for the movie, and use the media player 100 to re-transmit the selected movie to a television in the vicinity using the methods described herein.”), ¶176 (The media player can capture media, “stored on the device, and simultaneously transmitted to one or more target devices.”), ¶66 (“Media player 100 is able to access the Internet through the cellular network.”).

FIG. 19 of Dua presents an example user interface depicting a cellular connection signal indicator (blue in figure below) and a short range connection signal indicator (red). LG-1006, ¶¶__ ; *see also* LG-1006, FIG. 12, ¶¶210-211, 213 (pointing out the cellular signal indicator while the user is requesting a short-range connection), *id.*, ¶222 (indicating that the short range connection signal indicator shows “all devices that are currently connected to the media player 100” through such connection), *id.*, FIG. 13, ¶215 (explaining media player’s detection of peripheral devices that are “within signal range,” which means within the short-range coverage of transceiver 108 of the media player 100); [18d] *infra*.



LG-1006, FIG. 15 (annotated)

70. The multi-connectivity “allow[s] a user to browse movie trailers on his wireless media player 100, select a movie for download, pay for the movie, and use the media player 100 to re-transmit the selected movie to a television in the vicinity,” “to facilitate enhanced viewing, for example, on a large television with surround sound,” or to re-transmit the selected movie to an external player device “to share the incoming media with a friend in the vicinity that also has a wireless media player device.” LG-1006, ¶¶156, 168.

71. A user of the media player 100 has the options of selecting the external device (e.g., a television, a friend’s media player) manually or set the media player 100 to automatically connect to particular external devices when they are within the short-range communication of the media player 100. *Id.*, ¶¶163, 215, FIG. 13. The first time that media player 100 recognizes and connects to a particular external device, the media player 100 receives connections properties and other capabilities of the particular external device, for example, through an “RF exchange” of this information between the two devices. *Id.*, ¶115. Media player 100 then generates and stores on the media player a “device profile” for the particular external device to include the received information. *Id.*, ¶¶115, 147. “These device profiles can later be used by the media player 100 to automatically connect to these [external] devices when in the vicinity, or to manually connect to them based on the user selecting a profile and initiating the connection.” *Id.*; *see*

also id., FIGs. 12-20 (depicting an example of the manual user selection and a subsequent device connection and data transmission between the two devices.). While Dua describes this process as its “improved” process, Dua also discloses a “normal” process that requires manual configuration. LG-1006, ¶¶9, 10, 123, 124. While the “improved” process automates several aspects of selecting a radio connection, it would have been obvious to a POSITA to use a “normal” process that requires/allows the user to manually/explicitly specify the radio connection. *See id.*; *see also* LG-1005, 29 (“To send text using Bluetooth connectivity, open *Notes [application]*, write the text, and select Options > ***Send*** > ***Via Bluetooth.***”); LG-1006, ¶215 (“FIG. 13 is an illustration of an exemplary user interface screen 610 depicting a specific device profile category in accordance with one embodiment of the present invention. This screen 610 shows the “television” category with two example device profile entries 611 and 612. ...Device profile 612 differs from 611 in that an auto-detection setting 613 is represented; this setting is currently turned “on” as illustrated. The setting indicates that the user has specified that he wants the media player 100 to automatically detect and establish a connection with the TV in 612 whenever it is within signal range.”), ¶220 (“FIG. 14 is an illustration of an exemplary user interface screen 620 depicting messaging that indicates that the media player 100 is wirelessly connecting to a target device.... The screen 620 may appear on the media player 100 when an RFID

exchange is initiated and the devices attempt to wirelessly connect, or *when a device profile is selected in order to establish a manual connection.*”), *id.*, FIGs. 13 and 14 (FIG. 14 showing connection to the same peripheral device “TV-XYZ Elect. Family Roo” that FIG. 13 presented as requiring manual selection).

F. Barnes (LG-1007)

72. Barnes discloses a portable device 101, such as a mobile phone, that is capable of making simultaneous communication connections with multiple external devices and networks. LG-1007, ¶58 (“communication module 105 [of device 101] allows the user to *establish and maintain multiple communication links contemporaneously* (wired and wireless) *such as a wireless voice communication link (e.g., via a 3G network), multiple wireless data communication links (e.g., a wireless LAN and PAN link)*, and one or more wired links *simultaneously.*”), ¶38 (“*the device 101 is configured to receive and transmit* (and store) conventional digital communications, which include mobile telephone communications, and other data communications including *Internet data, mobile videophone communications, and to receive digital television signals*, and digital radio signals (e.g., XMGR radio signals). Preferably the device 101 is configured to *operate with a conventional mobile telephone network or wireless wide area network (WWAN), and one or more other wireless local area networks (wireless LAN or WLAN), wireless Metropolitan Area Networks*

(MAN), and a wireless personal area networks (PAN) (e.g., a Bluetooth® network).”).

73. The device 101 is capable of transmitting and receiving video files through a first communication link while also being connected to a second communication link. LG-1007, ¶61 (“the contemporaneous wireless communication links of the present invention permits the user to participate in a conversation via a voice communication link (e.g., via a 3G, 2.5G, or 2G network) while ***simultaneously*** using a data communication link (e.g., via a WLAN, PAN, 3G, 2.5G, or 2G network) to receive or send emails, transmit and receive data via the Internet, download audio or video files, upload and download data, or otherwise transmit and/or receive data. Thus, the user can also ***receive and transmit live audio/visual data***—such as live video transmissions (e.g., a video telephone call, receive a television transmission, transmit video camera data), and live audio transmissions (e.g., a telephone call, receive radio transmission, transmit voice data)—***while also transmitting and receiving computer data such as emails, word processing files, spreadsheet files, application files, and data to remote computer systems (e.g., such as a web page from a web server) and non-live audio/visual data (previously stored audio data and video data).***”).

74. The device 101 can also “route certain data to remote devices during live or non-live presentation.” LG-1007, ¶63. “For example, a video transmission

or computer data (e.g., web pages) received by the device 101 may be routed (e.g., as requested by the user) to a remote display device (e.g., via a wireless PAN to a display in an automobile) that may be large or of better quality than the display of the device.” *Id.*

G. Kao (LG-1017)

75. Kao discloses a radio transceiver capable of supporting multiple modulation formats. LG-1017, Abstract. Kao’s “primary reason for adopting [a] system supporting a plurality of modulation formats [is] that the data rates of the different modes or different standards are not the same.” *Id.*, ¶28. Kao lists a few wireless communication standards such as IEEE 802.11g and GSM, and their respective known parameters such as modulation schemes and bandwidth. *Id.*, ¶¶28, 31.

X. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 18-20 Are Obvious over Honkanen and N95.

i. Honkanen-N95 Combination

76. Honkanen provides techniques to reduce interference in simultaneous connections made by a device. LG-1004, ¶¶1, 48-53; *see also id.*, ¶2 (“[i]t is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth[] technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet Surfing, for

example.”). As an example multi-connection device, Honkanen discloses a “communication device 100 [that] comprises a number of communication interfaces 110 to 114” that each employs a “different radio access technolog[y].” *Id.*, ¶¶22, 25.

77. Honkanen explains that when an application on the communication device 100 needs a radio connection, “the application sends a request [to a common control element 210 of the device] to establish the connection.” *Id.*, ¶¶30, 37-38. The request specifies the radio connection that the application needs to connect to. LG-1004, ¶39 (“[the common control element 210] processes *requests for a radio connection coming from an application* or from the connection selection manager. The connection request processing block 304 *checks at least the validity of a request* and *the availability of radio resources* related to the request. Checking the validity of a request comprises checking, whether or not *the requested radio connection* is available in the communication device. Checking the availability of the radio resources comprises checking *which* and how many *radio connections are in operation*, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If *the requested connection* is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the

creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.”), ¶31 (“*the applications* 200 to 204 may be designed to *define the suitable connections by themselves*”).

78. Honkanen, however, does not provide details on how the application’s connection request is formed. To get such details, a POSITA would have looked to example communication devices that similar to Honkanen, that uses multiple radios and runs applications that are capable of requesting particular radio connections; and N95 provides one of those devices.

79. As explained earlier, the N95 device is capable of making a variety of wireless connections, including Bluetooth and WLAN connections. (citing to LG-1005, 13, 25-31). An application on N95 can request transmitting data through a particular radio connection. LG-1005, 19 (“Use the access point for *applications that need to connect to the internet*”), 29 (“To send text using Bluetooth connectivity, open *Notes [application]*, write the text, and select Options > *Send > Via Bluetooth.*”), (“send an image to another [Bluetooth] compatible device [through a] *Gallery [application]*”). In an example, N95 clarifies that the application request is formed when a user opens the application and selects transmission of a particular file stored or created on the application. More

particularly, N95 allows the user to (1) “[o]pen the application where the item [the user] wants to send is stored,” (2) “[s]elect the item and Options > Send > *Via Bluetooth*,” (3) and “[s]elect the device which [the user] want[s] to connect;” and “[w]hen the connection has been established,” the data is being sent. LG-1005, 29; see also id, 60 (“*To send a video clip, select Options > Send > Via multimedia, Via e-mail, Via Bluetooth*”).

80. A POSITA would have been motivated to apply a similar procedure to the communication device 100 in Honkanen to create an application request for device-to-device data transmission through a radio connection such as Bluetooth. An application on a Honkanen-N95 device would allow the user to request a Bluetooth connection to transmit a particular type of data.

81. A POSITA had multiple reasons to use the user input disclosed in N95 in the connection selection process of Honkanen, particularly for a direct device-to-device connection.

82. *First*, Honkanen is a Nokia patent application, focusing only on a particular aspect— i.e., the capability of communicating through different radio connections—of a communication device. A POSITA looking for details on other aspects of the device would have looked at other Nokia devices with similar features. N95 device is one of those. Similar to the communication device in Honkanen, N95 devices can communicate to multiple external devices and

networks through different radio connections. LG-1005, 13 (depicting graphical user interface indicators for different radio connections on the N95 device).

83. ***Second***, the user’s direct involvement in Bluetooth connection (as discussed in N95) can improve the security of the user device by allowing the user to control which external devices can connect to the user device. By the priority date of the ’284 Patent, it was well-known that direct device-to-device connections (such as Bluetooth) were prone to security breaches, and thus, the user’s direct involvement in selecting the target device to connect to would reduce the chance of connecting to a malicious device. LB-1003, ¶¶___; *see also* LG-1005, 29 (where N95 provides “***security tips***” such as (i) turning Bluetooth or keep the device “hidden” so that the user “***better control*** who can find [the user’s] device with Bluetooth wireless technology, and connect to it,” (ii) “not pair[ing] with or accept connection requests from an unknown device” ***so that the user “can better protect [the user] device from harmful content.”***); *id.*, 30 (where N95 suggests setting a device as “authorised” to pair for a Bluetooth connection only for the user’s “own devices” and “devices belong to someone [the user] trust[s].”); LG-1004, ¶23 and FIG. 1 (where Honkanen differentiates the Bluetooth connection 120 from other connections 116 and 118 by showing an association between Bluetooth-connected component 106 and the user device through a dashed border that contains the component 106 but not the other external devices/systems 112, 124).

84. **Third**, Honkanen indeed contemplates receiving user input in selecting a radio connection. Honkanen suggests that “a user or an operator” “define[s] connection profiles” that the communication device stores and later uses to “select an appropriate connection for an application.” LG-1004, ¶31; *see also id.*, ¶27 (contemplating a “user interface 102” such as “a keyboard, a microphone, a loudspeaker, a display, and/or a camera,” that can be used for receiving user inputs). While Honkanen discusses storing the user inputs as “connection profiles” to be used by an optional connection selection manager 206 of the device, a POSITA would have understood that the applications, too, could benefit from such profiles, or more generally, from user’s input each time that an application needs to specify an appropriate connection to transmit data. And N95 provides an example of such a scenario, where the user input specifies a particular connection, e.g., Bluetooth, upon opening the target application and selecting the item to be transmitted. *Id.*

85. **Fourth**, applying N95’s Bluetooth connection procedure to Honkanen is nothing more than utilizing a familiar known technique in selecting a radio connection to achieve a predictable result of improving security in connecting to reliable or known external devices rather than allowing a purely automatic Bluetooth connection with any external device.

86. A POSITA would have reasonably expected success incorporating N95's Bluetooth connection procedure into Honkanen given Honkanen's teachings, N95's practical application as a user device produced by Nokia (i.e., Honkanen's assignee), and the well-known practice of requiring a user selection for Bluetooth connections. *see also* LG-1010, 85-86 (where user input was used for selection of Bluetooth connection), LG-1011, 1168, 1199-1200 (indicating the need for a user input for Bluetooth pairing of devices and connection authorization).

ii. Claim 18

[18pre] A method for video processing, the method comprising:

87. To the extent the preamble is limiting, Honkanen-N95 renders it obvious.

88. Claim 18 does not specify any particular aspect of a video processing method. It only goes as far as "transmitting" "digital video information." . As discussed below, Honkanen-N95 renders obvious a method for video processing within the scope of claim 18.

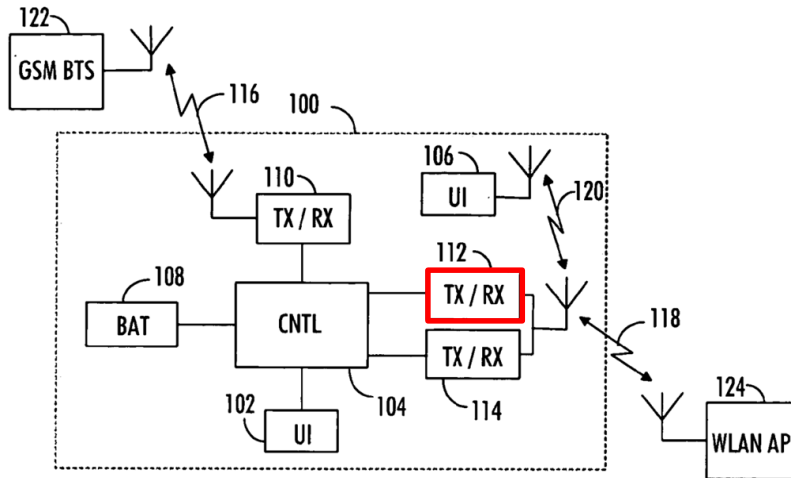
89. Honkanen discloses examples of connections for digital video broadcasting. LG-1004, ¶25. Further, a Honaken-N95 device would have a Bluetooth communication interface 112, 218 (LG-1004, ¶23) that could be used for

transmitting digital video information such as video clips to another device (LG-1005, 28-29). *see supra* section X.A.i.

[18a] transmitting, via a first radio communication circuit, digital video information by radio to an external apparatus;

90. Honkanen-N95 renders obvious transmitting via a first radio communication circuit (e.g., via Bluetooth communication interface 112, 218), digital video information (e.g., video clips) by radio (e.g., radio transmission through wireless connection 120) to an external apparatus (e.g., to user interface component 106 in Honkanen such as a computer, phone, or another device in N95).

91. As discussed in section IX.A, Honkanen discloses methods for “controlling a number of simultaneous ***radio*** connections in a communication device.” LG-1004, ¶1. To make such radio connections, the communication device 100 in Honkanen uses respective communication interfaces. *Id.*, ¶22 (“The communication device 100 comprises a number of *communication interfaces 110 to 114 to provide a wireless radio connection*. The communication interfaces 110 to 114 may be configured to *provide connections employing different radio access technologies*.”). “***A communication interface 112*** provides [a] ***wireless connection 120***, using ***Bluetooth®-technology***, with ***a user interface component 106***.” *Id.*; *see also id.*, FIG. 2 (depicting Bluetooth communication interface 232).



LG-1004, FIG. 1 (annotated to depict the claimed “first radio communication circuit”)

92. Similar to the “first radio communication circuit” in claim 18, the communication interface 112 is a radio communication circuit because it makes a *radio* connection (i.e., Bluetooth) to an external apparatus (e.g., to user interface component 106) to transmit digital data. The communication interface 112 has a *circuit* that “takes care of encoding and decoding [digital] data into suitable electrical waveforms for transmission and reception” according to Bluetooth “radio access-specific standard.” ; LG-1004, ¶36 (“*Each communication interface takes care of encoding and decoding data* into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out *according to each radio access-specific standard*. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, *Bluetooth*®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio

controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.”). Thus, the communication interface 112 renders obvious the claimed *first communication circuit*.

93. While Honkanen provides only one example (i.e., a “headset”) for the external user interface component 106 (LG-1004, ¶23), connecting to other types of external devices with Bluetooth compatibility would have been obvious to a POSITA. N95 provides other example external devices such as “computer,” “phone,” “audio or video device” for Bluetooth connections with a user communication device. LG-1005, 29.

94. N95 also provides example types of digital content that can be transmitted through such Bluetooth connections. N95 discloses: “You can use ***Bluetooth connectivity to send*** images, ***video clips***, music and sound clips, and notes.” LG-1005, 28, 60. Therefore, the Honkanen-N95 combination renders obvious *transmitting, via a first radio communication circuit* (e.g., communication interface 112) *digital video information* (e.g., video clips) *by radio* (e.g., by Bluetooth) *to an external apparatus* (e.g., a user interface component 106, a computer, a video device, etc.), as recited in [18a].

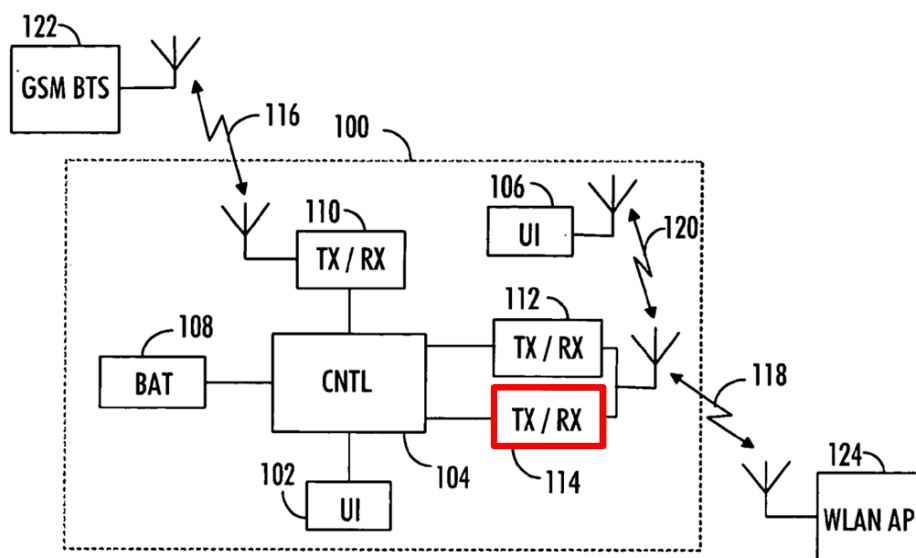
[18b] connecting, via a second radio communication circuit, to an internet or a home network;

95. Honkanen-N95 renders obvious connecting, via a second radio communication circuit (e.g., via WLAN communication interface 114, 230), to an

internet or home network (e.g., to the Internet via a home network such as a WLAN).

96. Honkanen recognizes that “users are willing to use different radios *at the same time*, like using a headset employing wireless *Bluetooth®* ... **and using a wireless local area network (WLAN) connection for Internet surfing.**” LG-1004, ¶2.

97. For a WLAN radio connection, Honkanen provides communication interface 114 on the communication device 100. “The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.” LG-1004, ¶22; *see also id.*, FIG. 2 (depicting WLAN communication interface 230).



LG-1004, FIG. 1 (annotated to depict the claimed “second radio communication circuit”)

98. Like the “second radio communication circuit” in claim 18, communication interface 114 in Honkanen is a radio communication circuit because it makes a *radio* connection (i.e., WLAN connection to access point 124) to the internet (e.g., to surf the Internet). The WLAN communication circuit 114 has a *circuit* that “takes care of encoding and decoding [digital] data into suitable electrical waveforms for transmission and reception” according to WLAN “radio access-specific standard.” ; LG-1004, ¶36 (“*Each communication interface takes care of encoding and decoding data* into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out *according to each radio access-specific standard*. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, *WLAN*, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.”). Thus, the communication interface 114 renders obvious the claimed *second radio communication circuit*.

[18c] receiving digital information;

99. By the priority date of the '284 patent, it was well-known that information (e.g., Internet-based information) received through, for example, WLAN included “digital” information. *See e.g.*, LG-1016, 48-51.

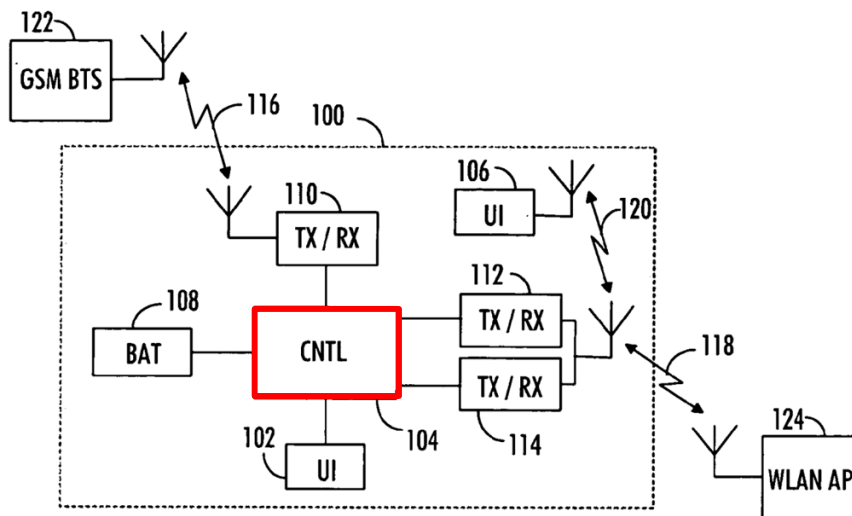
100. It would have been obvious to a POSITA that communication device 100 in Honkanen receives digital information through its WLAN interface, so that the user can, for example, “surf the internet.” (citing LG-1004, ¶2). Indeed, all of the devices that Honkanen lists as examples of the communication device 100 were known to have the capability of receiving and using digital information. LG-1004, ¶21 (“The communication device 100 may be for example a personal communication device *such as a mobile communication device, a computer, a laptop, or a PDA (Personal Digital Assistant).*”); see also *id.*, ¶25 (“the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, ... *DVB-H (Digital Video Broadcasting for Handheld devices)*, UWB (Ultra Wideband), GPS (Global Positioning System).”).

[18d] controlling each of the first and second radio communication circuits such that the first radio communication circuit transmits digital video information to the external apparatus and the second radio communication circuit connects to the internet or the home network simultaneously;

101. Honkanen-N95 discloses or renders obvious controlling each of the first and second radio communication circuits such that the first radio communication circuit (e.g., Bluetooth communication interface 112, 232) transmits digital video information (e.g., video clip) to the external apparatus (e.g., to user interface component 106, an external PC, phone, video device) and the

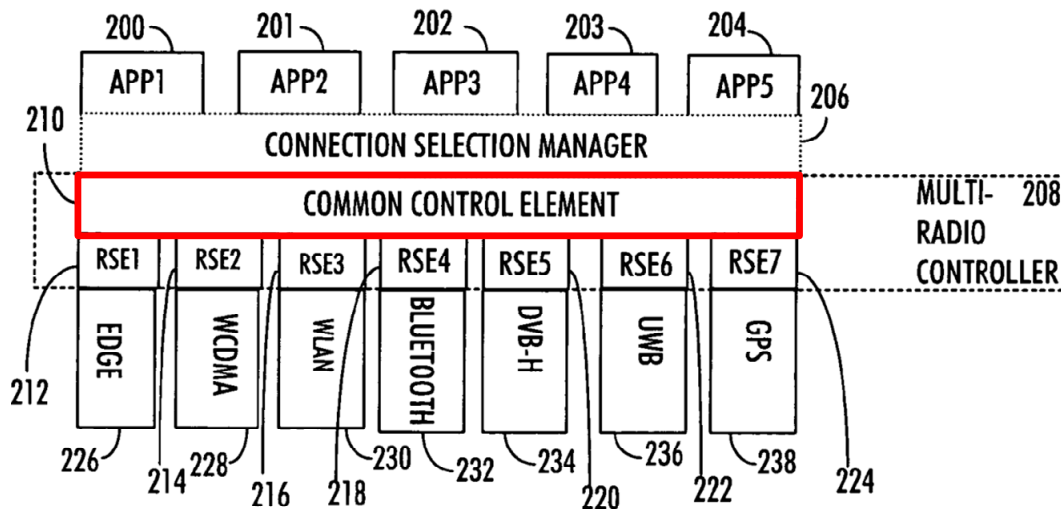
second radio communication circuit (e.g., WLAN communication interface 114, 230) connects to the internet or the home network (e.g., connects to the Internet) simultaneously.

102. As explained in section IX.A *supra*, Honkanen focuses on the techniques “for **controlling a number of simultaneous radio connections** in [the] communication device [100].” LG-1004, ¶5. Communication device 100 includes “a control unit 104 [that] comprises means **for controlling a number of simultaneous radio connections in the communication device 100.**” *Id.*, ¶26; see *also id.* (“The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks.”).



LG-1004, FIG. 1 (annotated to depict control unit 104)

103. To give more details about controlling simultaneous radio connections, Honkanen provides “an example of an architecture of the communication device 100” in its FIG. 2. *Id.*, ¶29. FIG. 2 (which was described *supra* in section IX.A) depicts a “multiradio controller 208,” that as described for control unit 104, “is responsible for taking care of the simultaneous operation of multiple radio connections,” and “establishes, controls, and terminates radio connections according to the connection requirements from the higher layers.” *Id.*, ¶¶32-33.



LG-1004, FIG. 2 (annotated to depict common control element 210)

104. Since Honkanen’s control unit 104 (or 210) controls the operations of Bluetooth and WLAN connection interfaces 112, 114 (or 230, 232) *simultaneously*, and since the Bluetooth connection interface is used to transmit video clips to an external user interface 106 (*see supra* regarding [18.a]) and

WLAN connection interface is used for internet communications (*see supra* regarding [18.b]), it would have been obvious that the control unit 104/210 controls the two communication interfaces (i.e., *first and second communication circuits*) such that the Bluetooth connection interface (*first radio communication circuit*) transmits video clips (*digital video information*) to the external apparatus and WLAN connection interface (*the second radio communication circuit*) connects to the internet *simultaneously*.

[18e] controlling assignment between the first radio communication circuit and the external apparatus, and assignment between the second radio communication circuit and the internet or the home network;

105. Honkanen teaches controlling assignment (e.g., assigning or adjusting connection parameters such as transmission frequency, transmission schedule, etc.) between the first radio communication circuit (e.g., Bluetooth communication interface) and the external apparatus (e.g., an external computer or phone), and [controlling] assignment (e.g., assigning or adjusting connection parameters such as transmission frequency, transmission schedule, etc.) between the second radio communication circuit (e.g., WLAN communication interface) and the internet or the home network.

106. As discussed *supra* in Claim Construction section VII.A, an assignment between a radio communication circuit and an external apparatus or network (given the need to control connection such that the assignment (or

priority) of one connection is more than the other) means *assigning particular connection parameter(s) to the connection formed between* the communication circuit and the external apparatus or network.

107. Honkanen, too, controls assignments between the first communication circuit and the external apparatus, and between the second communication circuit and the Internet by assigning particular connection parameters such as transmission bandwidth and transmission schedules to the respective connections formed by the first and the second communication circuits. *see also* [18f.1] *infra* for the discussion regarding assigning “more than” to one connection as compared to the other.

108. More specifically, “[t]he common control element 210” in Honkanen is “responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection” whenever the common control element 210 detects a potential interference with an existing connection. LG-1004, ¶33. For example, “[i]f an operational radio connection exists that uses the same radio resource(s) as [a newly requested] connection,” the common control element “*may define the parameters for the new connection so that interference between the two connections is minimized,*” or “*may adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).*” LG-1004, ¶47;

see also id., FIG. 3 and ¶37 (discussing the elements of the common control element 210). “The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections.” *Id.*, ¶44. This information is stored in the common control element 210. The common control element 210 “may first check, whether or not an existing, operational connection exists that uses the same radio resources”—i.e., the same connection parameters—“as the newly requested connection would use.” *Id.*, ¶45. “These radio resources comprise a frequency band, time domain, and space domain.” *Id.*

109. Therefore, to minimize the interference between existing connections (or between an existing connection and a newly requested connection), the common control element 210 in Honkanen adjusts/assigns the connections parameters such as “frequency band, time domain, and space domain” of the existing (or the newly requested) connections. *See* LG-1005, ¶49 (“For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band.”). Such connection parameter adjustment of the two potentially interfering connections renders obvious *controlling the first and second assignments* recited in [18e].

[18f.1] controlling the assignment such that the assignment between the first radio communication

circuit and the external apparatus is prioritized² more than the assignment between the second radio communication circuit and the internet or the home network

110. Honkanen-N95 discloses or renders obvious controlling the assignment (e.g., adjusting/assigning connection parameters such as overlapping transmission frequencies, or transmission schedules) such that the assignment between the first radio communication circuit and the external apparatus (e.g., the share of the Bluetooth connection in the overlapping transmission frequencies, or the priority in scheduling Bluetooth transmissions) is (prioritized) *more than* the assignment between the second radio communication circuit and the internet or the home network (e.g., is more than the share of the WLAN connection in the overlapping transmission frequencies, or has a higher priority in transmission time than in scheduling WLAN transmissions).

111. While the claim is not explicit as to what it means to control one connection “assignment” to be (prioritized) “more than” another connection assignment, the ’284 Specification suggests that giving an assignment to a first connection “*more than*” an assignment to a second connection means giving a “*higher priority*” to the connection parameters of the first connection as compared

² Added in a Certificate of Correction and received no examination post Issuance of the Patent. LG-1002, 1-4.

to the connection parameters of the second connection for the purpose of transmitting video. LG-1001, 2:13-19 (“The control unit *assigns connection of the first radio communication unit with **higher priority*** and controls the *assignment of the transmission rate*, for example, such that the transmission rate between the first radio communication unit and the external video display apparatus is *more than* the transmission rate between the second radio communication unit and the network.”); *id.*, 2:32-36 (“The controller controls the operation such that the assignment to the first radio communication module *to conduct transmission to receive video information* from an external video processing apparatus is carried out with *higher priority*.”); *id.*, 12:43-51 (“In the embodiment, the controller 2013 and the transmission rate assignment controller 2017 *control the radio transmission rate assignment* so *that the radio transmission rate* of the modem 2015 to receive the video information of high picture quality by radio from the external video processing apparatus 100 *takes precedence* over the radio transmission rate of the modem 2016 to connect to a network for communication. In short, the radio transmission rate of the modem 2015 is *more than* that of the modem 2016.”); *id.*, 8:7-24 (“According to the embodiment, the controller 132 and the transmission rate assignment controller 1001 *control the radio transmission assignment such that the radio transmission rate of the modem 1002* to send the video information of high picture quality by radio to the video display apparatus

200 *takes precedence over the radio transmission rate of the modem 1003* to connect to a network for communication. That is, the radio transmission rate of the modem 1002 *is more than* that of the modem 1003. For example, in a situation wherein the modem 1002 transmits video information to the display apparatus 200 and the modem 1003 simultaneously connects to the Internet to receive Internet information, the controller 132 *controls the operation to continuously supply videos with high picture quality* to the user, specifically, *to set the transmission scheme of the modem 1002 to*, for example, ‘*scheme 1*’ shown in FIG. 9. *For the radio modem 1003, the controller 132 sets the transmission scheme thereof to ‘scheme 2’ of FIG. 9.”*; *id.*, FIG. 9 (listing bandwidth, modulation scheme, and transmission capacity as example transmission schemes).

112. In its Infringement Contentions, without providing an opinion about the correctness of Patent Owner’s interpretation of this or any other claims, I note that Patent Owner took a similar position with respect to the “more than” language and contemplated that assigning to a first connection “*more than*” to a second connection, means “*prioritizing*” the first connection to the second connection for the particular purpose of video transmission. *See e.g.*, LG-1012, 85 (“Specifically, upon information and belief, under certain conditions the controller (e.g., CPU) of each of the 284 Accused Products executes software *to prioritize the assignment* between the Wi-Fi communication chip and the external

video processing apparatus *more than* the assignment between the cellular communication chip and the internet or the home network when a user issues an indication to transmit digital video information by the Wi-Fi communication chip while acquiring information from the internet or the home network by the cellular communication chip. In other words, on information and belief, *prioritization is accomplished by determining which data is transmitted by which radio communication circuit, and favoring the prioritized circuit in this determination.*”), 95 (“...the controller (e.g., CPU) of each of the 284 Accused Products *executes software to prioritize* using the cellular communication chip over Wi-Fi *for transmitting a video* (e.g., via MMS or e-mail).”).

113. Similarly, the Honkanen-N95 combination teaches that in a situation where two connections interfere (e.g., use the same frequency band), the connection that carries video data is prioritized over the other connection, for example, by using frequencies for the lower priority connection that avoid the higher priority connection, or by prioritizing a transmission schedule of the higher priority connection. This is explained below in detail.

114. As discussed *supra* in section X.A.i and [18e], Honkanen provides techniques *to reduce interference* in transmissions of connections that share some radio connection resources like Bluetooth and WLAN. LG1004, ¶47 (“If an operational radio connection exists that uses the same radio resource(s) as the

requested new connection,” the common control element 210 “define[s] the parameters for the new connection so that interference between the two connections is minimized,” and “may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).”). Two of Honkanen’s interference reducing techniques involve (i) frequency bandwidth adjustment, and (ii) connection scheduling—which as discussed earlier (*see* Claim Construction *supra*) are examples of connection parameter assignment/adjustments. Either and both of these techniques render obvious *controlling the assignment such that the assignment between the first radio communication circuit and the external apparatus is more than the assignment between the second radio communication circuit and the internet or the home network*, recited in claim feature [18f.1].

1) assigning the overlapping frequencies to a particular connection

115. In an example situation where a newly requested connection uses transmission frequencies (e.g., a frequency band) that overlaps with transmission frequency of an already existing connection, Honkanen suggests assigning the overlapping frequency to only one of the two connections to reduce the communication interference. LG-1004, ¶¶48-49. “For example, a Bluetooth®

connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band.” LG-1004, ¶49. When a Bluetooth connection is newly requested while a WLAN connection already exists, Honkanen proposes *prioritizing* one of the Bluetooth and WLAN connections to the other so that *the higher priority connection* uses the overlapping transmission frequency band. (citing to LG-1004, ¶49). For example, the device can *prioritize* the existing WLAN over the new Bluetooth connection by “prevent[ing] the Bluetooth connection from hopping to the frequencies the WLAN connection is using.” LG-1004, ¶49.

116. Conversely, the communication device can also prioritize the new Bluetooth connection over the existing WLAN connection, and adjust the connection parameters of the existing connection so that the overlapping frequencies are assigned to the new Bluetooth connection. citing LG-1004, ¶49 (noting that the newly requested connection can be prioritized to use the overlapping frequency band over the existing connection). In such a converse scenario, the device would prevent the WLAN from using the frequency band over which Bluetooth would operate when Bluetooth is transmitting, and thus, would *prioritize* the Bluetooth connection over WLAN by narrowing the WLAN bandwidth.

117. Such prioritization would have been at least obvious to a POSITA because (i) it is in line with Honkanen’s goal of reducing communication

interfaces, and (ii) Honkanen suggests adjusting the connection parameters of the existing connection when the existing connection shares some resources (e.g., transmission frequencies) with the new connection. citing LG-1004, ¶47 (The device “may also *adjust the parameters of the existing connection* in order to minimize the interference between the two connections using the same radio resource(s).”), *id.*, ¶33 (“The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections *by adjusting the parameters of an existing connection* whenever a new radio connection which would interfere with an existing radio connection is created.”). Further, implementing such prioritization would have been “obvious to try” because it constitutes “choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success”—i.e., choosing from two options of prioritizing one of the Bluetooth and WLAN connections over the other one of those connections by assigning the overlapping frequencies to one of the connections, and preventing the other connection from using the overlapping frequencies. MPEP §2143 (citing to *KSR*, 550 U.S. at 421); *see also* LG-1004, ¶49 (noting that the specific interference-minimization examples provided in the subsequent paragraphs are not limiting, and “other procedures for defining/adjusting the parameters of the radio connections are also possible.”).

118. Honkanen’s assignment of the overlapping frequency ranges between the two interfering connections is in line with the disclosure of the ’284 Patent. The ’284 Patent explains that when *the transmission rate* of a first communication circuit “takes precedence”—i.e., is prioritized—over that of a second communication circuit, “if the [frequency] band of signals [for the first communication circuit] is expanded, that of signals [for the second communication circuit] *narrows*.” LG-1001, 11:52-12:10. This is because the frequency band of the radio signals for the communication circuits is “fixed,” and thus, expanding the operating band for one of the communication circuits results in narrowing the operating band for the other communication circuit. citing LG-1001, 11:52-12:10.

119. Similarly, Honkanen’s assignment/adjustment of the operating frequency bands for the Bluetooth and the WLAN communication interfaces results in *narrowing* the bandwidth in the lower priority connection for *a higher transmission rate* in the higher priority connection. More particularly, by preventing WLAN communications from using the frequencies that overlap with Bluetooth’s operating frequencies, WLAN’s operating frequency band would be narrowed; a result that was recognized in the ’284 Patent too.

120. Therefore, Honkanen makes it obvious to a POSITA to (at least try to) prioritize the Bluetooth connection (*assignment between the first radio communication circuit and the external apparatus*) relative to the WLAN

connection (*assignment between the second radio communication circuit and the internet*) by adjusting the operating bandwidth of the WLAN communication interface 114 (*second radio communication circuit*) and preventing it from operating on the frequencies that the Bluetooth communication interface 112 (*first radio communication circuit*) uses. Alternatively, Honkanen's teachings would have rendered it obvious to a POSITA that when Bluetooth hops into a band that WLAN is using, the WLAN would be paused from operating in that band.

121. Further, a POSITA *would have been motivated to prioritize the Bluetooth* communication in Honkanen-N95 combination to achieve a smooth transmission of video clips with low interruptions. As discussed *supra* in [18a], Honkanen-N95 uses its Bluetooth communication interface to transmit video clips to an external device. By the priority date of the '284 patent, it was well-known that transmitting video (particularly live video) clips require a high bandwidth and high transmission rate, for example, to avoid interruption in watching the video. LG-1007, ¶¶65-66 ("*the determination of the available network with which to establish one more communications is based on* one or more of the available bandwidth of each available network (i.e., the amount of data that can be communicated over a given time period), *the anticipated bandwidth necessary, ... the amount of data to be transmitted, ...*" "If the user desires *to download and watch a movie* (which may determined by a user input in response to a prompt or

by the user opening an audio/video player for external retrieval of the video file), *relatively high bandwidth can be anticipated as being needed....*”); LG-1013, ¶3 (“Previous generations of hand-held mobile terminals were capable of *supporting multimedia and video/audio applications, but this capability was diminished by the relatively low data rates that conventional wireless networks could achieve.* This problem is being addressed by new wireless communications standards and equipment that provide much higher data rates.”); *id.*, ¶21 (“Mobile terminal 110 is also capable of communicating with one or more types of external (or remote) devices in a short-range wireless interface standard, such as IEEE-802.11x, ultra-wideband (UWB), IEEE-802.15.3x, MB-OFDM, Wireless USB, or *a Bluetooth standard that supports high throughput applications*, among others. ... *If the remote device is capable of displaying video (e.g., television 131), it is assumed that the wireless transceiver of the remote device supports a relatively high data rate that is suitable for video applications and/or multimedia applications.*”); LG-1014, ¶118 (“As one of average skill in the art will appreciate, the mixing of data performed by mixer 342 may utilize *a prioritization scheme depending on the type of data* being mixed. For example, if the data being mixed includes *real time audio and/or video data, such data may take priority* over non-real time video and/or audio.”)).

122. Since in a Honkanen-N95 device, the user selects Bluetooth to transmit a video clip, it would have been obvious to a POSITA that the device would prioritize (i.e., *assign more*) Bluetooth over WLAN to give as much of the overlapping frequencies to the Bluetooth communication as needed to provide a smooth transmission of the video clip.

2) Assigning transmission schedules

123. Scheduling assignment is another technique that Honkanen provides to reduce interference between two connections that share some radio resources. To do so, Honkanen “check[s] whether it is possible to schedule the two connections so that the connection[s] will not be transporting data at the same time.” LG-1004, ¶50.

124. While Honkanen does not specify prioritizing the schedule of transmitting video over transmitting the Internet-based data (e.g., email communications, audio downloads, etc.), it would have been obvious to a POSITA to make such prioritization to avoid interruptions in streaming video on the destination external display, for example, in a live broadcast. citing LG-1014, ¶118 (“As one of average skill in the art will appreciate, the mixing of data performed by mixer 342 may *utilize a prioritization scheme depending on the type of data* being mixed. For example, if the data being mixed includes *real time*

audio and/or video data, such data may take priority over non-real time video and/or audio. Such real time video and/or audio can include telephone communications, *watching live broadcasts*, et cetera, while non-real time video and/or audio can include viewing a DVD, VCR, *listening to digital audio*, CD, DVD audio, et cetera. *The non-real time data may be transmitted* in large bursts *with greater time intervals between the bursts* and still provide a continuous flow of display data. *Conversely, real time data is transmitted more frequently* and in smaller bursts.”). Otherwise interruptions in the video transmission would be expected for the duration of simultaneous transmissions in the two connections (e.g., through Bluetooth and WLAN).

125. In view of the foregoing, the Honkanen-N95 combination renders obvious assigning adjusting/assigning connection parameters such as frequency band and transmission schedule (*controlling the assignment*) by prioritizing the connection parameters for the Bluetooth connection (*such that the assignment between the first radio communication circuit and the external apparatus is prioritized*) over the connection parameters for a WLAN connection to the Internet (*more than the assignment between the second radio communication circuit and the internet or the home network*), by (i) assigning the overlapping frequency band to the Bluetooth connection, and/or (ii) prioritizing the transmission schedule of the Bluetooth communications over WLAN communications, e.g., by assigning

more frequent transmission time to the Bluetooth communications than to the WLAN communications.

[18f.2] [controlling the assignment such that the assignment between the first radio communication circuit and the external apparatus is more than the assignment between the second radio communication circuit and the internet or the home network] when a user issues an indication to transmit digital video information by the first radio communication circuit while acquiring information from the internet or the home network by the second radio communication circuit.

126. Honkanen in view of N95 renders obvious [controlling the assignment such that the first assignment is (prioritized) more than the second assignment (*see supra* [18f.1])] when a user issues an indication to transmit digital video information by the first radio communication circuit (e.g., user selects a video clip to transmit via Bluetooth) while acquiring information from the internet or the home network by the second radio communication circuit (e.g., while the device is acquiring information from Internet through an existing WLAN connection).

127. As discussed *supra* in [18e] and [18f.1], Honkanen-N95 renders obvious **controlling the assignment** of an existing WLAN connection (i.e., [the connection] between the second radio communication circuit and the internet or the home network) and a new Bluetooth connection (i.e., [the connection] between the first radio communication circuit and the external apparatus) when the new connection is requested to be added **while the existing connection is in operation**

(i.e., when [a request to initiate the new connection is received] while ...the second radio communication circuit is in operation). *See also infra*, discussing that the existing connection in operation includes “acquiring information from the internet.”

128. It was also discussed *supra* in [18f.1] that the assignments are controlled such that the first assignment (*i.e., the assignment between the first radio communication circuit and the external apparatus*) is more than the second assignment (*i.e., the assignment between the second radio communication circuit and the internet or the home network*).

129. Therefore, it was already explained that Honkanen-N95 renders obvious controlling the assignment such that an assignment to the first connection is more than an assignment to the second connection when a request to initiate the first (new) connection is received while the second (existing) connection is in operation.

130. What remains in [18f.2] is a ***user indication*** “*to transmit digital video information by the first radio communication circuit.*” In other words, limitation [18f.2] requires a user’s involvement in the formation of the request to initiate the new connection via a specific radio for video transmission.

131. Honkanen-N95 renders obvious receiving from a user the selection (*a user issues an indication*) of both a video clip (*digital video information*) and

Bluetooth communication (*the first radio communication circuit*) for transmission of the video clip (i.e., *to transmit digital video information by the first radio communication circuit*). As discussed in section X.A.i *supra*, to initiate a Bluetooth transmission of an item, a user of the Honkanen-N95 device makes a series of menu selections that is concluded by selecting the receiving device. LG-1005, 28-29. The series of selections requires indicating both the item (e.g., a video clip), and the radio (Bluetooth). Once the destination device is selected, the selected item (e.g., a video clip) is sent to it through Bluetooth. ***Selecting the destination device as the concluding step constitutes the “an indication to transmit”*** the selected item (*digital video information by*) through the selected Bluetooth connection. LG-1005, 28-29.

132. Since in the Honkanen-N95 device the Bluetooth connection is made through a particular communication interface 112 (*see [18a] supra*) the user’s selection of Bluetooth conveys user’s indication to transmit the selected item (*indication to transmit digital video information*) by the communication interface 112 (*by the first radio communication circuit*). Importantly, the indication in N95 explicitly indicates transmission of digital video information via Bluetooth (the first radio communication circuit).

133. Honkanen-N95 also renders obvious receiving the user selection (*user indication*) while acquiring information by WLAN (*second radio communication*

circuit). Since Honkanen teaches adding Bluetooth as a new connection while an existing WLAN connection is already operating (*see* [18b] *supra*), it would have been obvious that in a Honkanen-N95 device, the user can cause the initiation of the Bluetooth connection (by selecting the Bluetooth connection and the item to be transmitted through Bluetooth), while the WLAN connection is already in operation (*i.e., while acquiring information by the second radio communication circuit*). LG-1004, ¶¶39, 49 (explaining that the new connection is formed *when* a request to make the new connection is received *while* an existing connection is operating.)

134. As discussed *supra* with respect to [18b], a Honkanen-N95 device uses a particular communication interface 114 for WLAN communications to connect to the Internet. A POSITA would have recognized that connecting to the Internet renders obvious *acquiring information from the internet. see also* [18e] *supra* (discussing “simultaneous” Bluetooth and WLAN connections, which constitutes connecting to the Bluetooth “*while acquiring information from the internet.*”). For example, Honkanen recognizes that a user can use WLAN to surf the Internet and at the same time, use Bluetooth to connect the user device to a headset. LG-1004, ¶2 (“It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth[] technology during a GSM phone call, ***and using a wireless local area network***

(WLAN) connection for Internet surfing, for example.”). It would have been obvious to a POSITA that users can initiate using a display or a headset (for example, to video call, or to watch a live video stream) through the Bluetooth connection while surfing the Internet through WLAN. In all these examples, users would submit their indication (e.g., through a call application, a web surfing application, or an audio play application) “*while acquiring information from the internet.*”

135. Therefore, Honkanen-N95 renders obvious controlling the assignment as specified in [18f.1] when a user selects to transmit (1) a video clip (2) through Bluetooth communication interface 112 (*i.e., when a user issues an indication to transmit digital video information by the first radio communication circuit*) while the device is acquiring information through an existing Internet connection network through WLAN communication interface 114 (*i.e., while acquiring information from the internet or the home network by the second radio communication circuit*).

iii. Claim 19

[19] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in frequency bandwidth.

136. Honkanen-N95 in view of the knowledge of a POSITA by the priority date renders obvious that the first radio communication circuit (e.g., Bluetooth

communication interface 112) and the second radio communication circuit (e.g., WLAN communication interface 114) are different from each other in frequency bandwidth (e.g., Bluetooth bandwidth vs. WLAN bandwidth).

137. As explained *supra* (see e.g., [18f.1]) Honkanen teaches avoiding interference between the Bluetooth and WLAN connections by “preventing” one of the connections to use the frequencies that overlap with the other connection. LG-1004, ¶49. Honkanen does not require termination of either of the connections, but only prevents operation of one of the connections on the overlapping frequencies. This means that the two communication interfaces (112 and 114) can keep operating on their non-overlapping frequencies, which suggests that the two communication interfaces *differ from each other in frequency bandwidth*.

138. Further, by the priority date of the '284 Patent, it was well-known that Bluetooth and WLAN connections use different frequency bandwidths; WLAN uses on the order of 20MHz bandwidth in 2.4 GHz frequency band (see e.g., LG-1016 46-48³; LG-1017, FIG. 1, ¶28), and Bluetooth uses 1MHz bandwidth to hop in a narrower portion of that frequency band—i.e., 2400-2483 MHz (see e.g., LG-1011, 198-200)—as these bandwidths were defined in the respective applicable

³ Referring to the page number of the pdf document.

standards (i.e., LG-1016 and LG-1011). Therefore, a POSITA would have recognized that in Honkanen-N95, the Bluetooth communication interface 112 (*first radio communication circuit*) and the WLAN communication interface 114 (*second radio communication circuit*) operate using different frequency bandwidths (*are different from each other in frequency bandwidth*).

iv. Claim 20

[20] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in modulation/demodulation method.

139. Honkanen-N95 in view of the knowledge of a POSITA by the priority date renders obvious that the first radio communication circuit (e.g., Bluetooth communication interface 112) and the second radio communication interface (e.g., WLAN communication interface 114) are different from each other in modulation/demodulation method..

140. As discussed in Honkanen, Bluetooth uses frequency hopping within the 2.4 GHz frequency band that WLAN operates on, and thus, uses a different modulation scheme than WLAN does. LG-1004, ¶49. Further, by the priority date of the '284 Patent, it was well known that WLAN communication circuits use CCK/DSSS/OFDM modulation/demodulation methods while Bluetooth circuits use GFSK/ $\frac{\pi}{4}$ DQPSK/8DPSK modulation methods as defined in their respective

applicable standards. LG-1016, 46-48; LG-1011, 198-200; LG-1017, FIG. 1, ¶28. Therefore, it would have been obvious to a POSITA that in Honkanen-N95, the Bluetooth communication interface 112 (*first radio communication circuit*) and the WLAN communication interface 114 (*second radio communication circuit*) use different modulation/demodulation methods (*are different from each other in modulation/demodulation method*).

B. Ground 1A: Claims 19 and 20 Are Obvious over Honkanen-N95 in View of Bluetooth-Specification and IEEE 802.11g Standards

141. While the specifics of Bluetooth and WLAN connections are inherent to those connections, and thus, claims 19 and 20 are obvious over Honkanen-N95 (GROUND 1), to the extent that a POSITA would need to search for such specifics, the POSITA would have looked into the standards that define them. Bluetooth Specification (LG-1011) and IEEE 802.11g (LG-1016) were published as standards disclosing the Bluetooth and the WLAN specifications, respectively. *see also* LG-1011, first page (titled partly as “***Specification of the Bluetooth System***”); LG-1016, first page (titled partly as “***Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications***”); LG-1017, FIG. 1, ¶28 (citing to IEEE 802.11g for the specifics of a WLAN connection).

i. Claim 19

[19] The method of claim 18, wherein the first radio communication circuit and the second radio

communication circuit are different from each other in frequency bandwidth.

142. The same arguments discussed above under Ground 1 also apply to Ground 1A for claim 19. Particularly, Honkanen-N95 in light of Bluetooth-specification and IEEE 802.11g combination render obvious using 1MHz bandwidth for Bluetooth connection (i.e., the connection formed by *the first radio communication circuit*) and 20MHz bandwidth for WLAN connection (i.e., the connection formed by *the second radio communication circuit*).

ii. Claim 20

[20] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in modulation/demodulation method.

143. The same arguments discussed above under Ground 1 also apply to Ground 1A for claim 19. Particularly, Honkanen-N95 in light of Bluetooth-specification and IEEE 802.11g combination render obvious using GFSK/ $\frac{\pi}{4}$ DQPSK/8DPSK modulation/demodulation scheme with frequency hopping for Bluetooth connection (i.e., the connection formed by *the first radio communication circuit*) and CCK/DSSS/OFDM modulation/demodulation scheme for WLAN connection (i.e., the connection formed by *the second radio communication circuit*).

**C. Ground 2: Claims 18-20 Are Obvious Over Dua and Barnes;
Ground 2A: claims 18-20 Are Obvious Over Dua-Barnes and N95**

i. Dua-Barnes Combination

144. Dua and Barnes are directed to the same field of technology as they both focus on a communication device capable of making simultaneous connections to multiple external devices/networks. *see also supra* sections IX.E and IX.F. For example, both user devices in Dua and Barnes are capable of connecting through multiple communication protocols simultaneously. Even more specifically, both user devices are capable of transmitting video content through to an external device in the vicinity of the user device while also being connected to a cellular network. *See supra* sections IX.E and IX.F. Both Dua and Barnes recognize that transmitting a video content to an external device (e.g., a TV) “facilitate[s] enhanced viewing” and provides “large[r or] better quality” presentation of the video content. LG-1006, ¶156; LG-1007, ¶63.

145. While Dua discloses a user’s selection of the external device (e.g., a particular display) for transmitting the video data to the external device, Dua does not provide details on how the communication device selects a proper connection for such transmission. *see also* LG-1006, FIGs. 13 and 14 (depicting user’s selection of the external device, and the connection to that device forming subsequently). A POSITA would have looked into similar references to learn how

the device can determine and prioritize the available connections for a smooth (and preferably uninterrupted) video transmission. And Barnes is one of those references.

146. Barnes explains that “when communications with the desired external system may be accomplished by more than one network, the device 101 must determine the available network with which to establish the communication(s).” LG-1007, ¶64. “[T]he determination of the available network with which to establish one [or] more communications *is based on* one or more of the available bandwidth of each available network (i.e., the amount of data that can be communicated over a given time period), *the anticipated bandwidth necessary*, the available capacity or relative available capacity (e.g., how full to capacity a network is), the historical (or anticipated) availability of bandwidth (which may include, for example, use, volume, capacity, and/or *speed data* for days of the week or times of the day), the communication capabilities of the device, the amount of data to be transmitted.” *Id.*, ¶65.

147. Barnes recognizes that video transmission requires “relatively high bandwidth,” and thus, suggests that if a certain connection “does not provide enough bandwidth to receive the communication (e.g., movie data file) in a desired manner *without buffering, [a] higher speed network is selected*” for the movie data file transmission. LG-1007, ¶66; *see also id.* (“If the user desires *to download*

and watch a movie (which may [be] determined by a user input in response to a prompt or by the user opening an audio/video player for external retrieval of the video file), *relatively high bandwidth can be anticipated as being needed.*”). Note that Barnes does not limit the constraints disclosed in its ¶66 to only downloading video, and there is no reason for assuming such limitation. Rather, those constraints apply to video transmission, in general. Alternatively, it would have been obvious to a POSITA to account for those constraints when selecting the right connection for video transmission based on the connection factors listed in the preceding paragraph (¶65).

148. Looking at Barnes, a POSITA would have been motivated to use a similar procedure in Dua and assign a connection with a “high bandwidth” (i.e., a “high speed” connection as presented in Barnes) for video transmission. A POSITA would have been motivated to do so for multiple reasons:

149. *First*, both Dua and Barnes are directed to similar fields of technology (as explained above) and provide for re-transmitting received video content for presentation on another display “that may be large or of better quality than the display of the [communication] device” (LG-1007, ¶63), for example, “to facilitate enhanced viewing” (LG-1006, ¶156).

150. *Second*, as Barnes recognizes, dedicating a high bandwidth connection to video transmission reduces a need to buffer the video data at the

destination device (e.g., an external display), and thus, reduces interruptions in displaying the video at the destination device. LG-1007, ¶66. Barnes views high bandwidth as an indicator of “the amount of data that can be communicated over a given time period,” and thus, suggests selecting a “*higher speed network*” for video transmission.

151. *Third*, Dua also recognizes video transmission constraints and suggests designing transceiver 108 “to support *the widest array of communication protocols and broadcast standards.*” LG-1006, ¶63. This disclosure suggests assigning the highest available short-range bandwidth to the connection between the communication device and the external device (e.g., the display).

152. *Fourth*, applying Barnes’ suggestion (on prioritizing a high bandwidth connection for video transmission) to Dua is nothing more than utilizing a familiar known technique in selecting a proper radio connection to achieve a predictable result of reducing interruption in (a live) video presentation on an external device.

153. A POSITA would have reasonably expected success applying Barnes’ suggestion to Dua given Dua’s teachings, Barnes’ explained benefit of reducing buffering, and the well-known issues with transmitting video contents wirelessly. *see e.g.*, LG-1013, ¶3 (“Previous generations of hand-held mobile terminals were capable of *supporting multimedia and video/audio applications,*

but this capability was diminished by the relatively low data rates that conventional wireless networks could achieve. This problem is being addressed by new wireless communications standards and equipment that provide much higher data rates.”); *id.*, ¶21 (“*If the remote device is capable of displaying video (e.g., television 131), it is assumed that the wireless transceiver of the remote device supports a relatively high data rate that is suitable for video applications and/or multimedia applications.*”); LG-1014, ¶118 (“As one of average skill in the art will appreciate, the mixing of data performed by mixer 342 may utilize *a prioritization scheme depending on the type of data* being mixed. For example, if the data being mixed includes *real time audio and/or video data, such data may take priority* over non-real time video and/or audio.”).

ii. Claim 18

[18pre] A method for video processing, the method comprising:

154. To the extent the preamble is limiting, Dua-Barnes renders it obvious.

155. A media player 100 in Dua-Barnes combination would be “capable of processing digital media such as audio, video, images, animation, presentations, and other content.” LG-1006, ¶4; *see also id.*, ¶57 (“The term ‘media player’ generally refers to electronic devices that are capable of processing media such as audio, video, images, presentations, animation, and Internet content, as for

example, cellular phones, personal digital assistants (PDAs), music players, game players, video players, cameras, and the like.”).

156. Claim 18 does not specify any particular aspect of a video processing method. It only goes as far as “transmitting” “digital video information.” . Dua-Barnes media player 100 is capable of transmitting digital video information. *Id.*; *see also* LG-1006, ¶200 (“The cryptographic techniques and methods for securing video and audio signals is widely known and documented. Commonly used algorithms supported by the media player 100 and used for **encrypting digital content include Digital Video Broadcasting.**”); *id.*, ¶¶142-143 and FIG. 7 (listing “MPEG,” which is a known digital video format, as a video format that the recipient device can receive.) *id.*, FIG. 16-19 (depicting transmission of a video content that a user selects); *see also* [18a] *infra*.

[18a] transmitting, via a first radio communication circuit, digital video information by radio to an external apparatus;

157. Dua-Barnes discloses or renders obvious transmitting, via a first radio communication circuit (e.g., short range transceiver 108), digital video information (e.g., a video file) by radio (e.g., though short-range radio connections such as Bluetooth, WiFi) to an external apparatus (e.g., to an external TV, to a friend’s media player)..

158. As explained *supra* in section IX.E, the media player 100 in Dua includes a “*short-range transceiver 108* and antenna 117 [that] provide wireless connectivity with *external devices* or access points using supported communications protocols (e.g., Bluetooth, 802.11 a/b/g/n, Ultra Wideband, Wireless USB, 802.15.3/WiMedia, Wireless 1394, Wireless Fire Wire, WiMax, and 802.15.4/ZigBee.” LG-1006, ¶62.

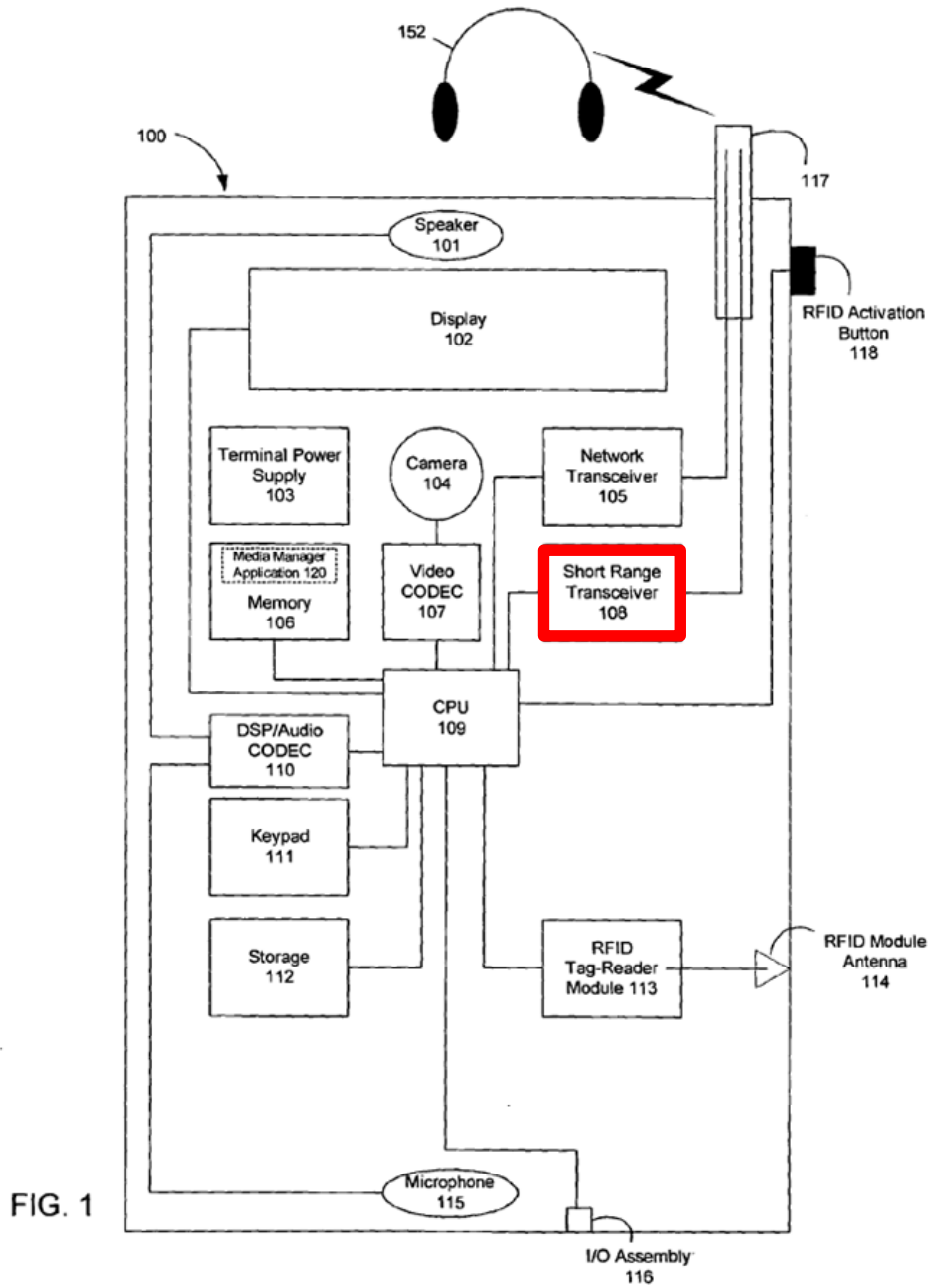


FIG. 1

LG-1006, FIG. 1 (annotated)

159. Dua teaches that a user can select a video file (*digital video information*) to send to the external device (*external apparatus*) through the short-range transceiver 108 (*via a first radio communication circuit*). For example, “[a] user that is engaged in viewing incoming media or listening to music stored locally

on the media player 100 [is] to automatically *establish a wireless connection with a target device and transmit the same media* for listening/viewing pleasure on the target device with minimal effort.” LG-1006, ¶158. As such, the user would be able to “*use the media player 100 to re-transmit the selected movie to a television in the vicinity*” “to facilitate enhanced viewing, for example, on a large television with surround sound,” or *to re-transmit the selected movie to an external player device* “to share the incoming media with a friend *in the vicinity* that also has a wireless media player device. *Id.*, ¶¶156, 168. Since the external device (e.g., television or friend’s media player) is “in the vicinity” of the user’s media player 100, it would be at least obvious that the media player uses its short-range transceiver 108 for transmitting the video file to that device. *see also* [18f.1] *infra* (explaining reasons for prioritizing the short-range transceiver 108 over the network transceiver 105 for such video re-transmission).

[18b] connecting, via a second radio communication circuit, to an internet or a home network;

160. Dua-Barnes discloses or renders obvious connecting, via a second radio communication circuit (e.g., network transceiver 105), to an internet or a home network (e.g., to an internet through a cellular network connection)..

161. As explained *supra* in section IX.E, the media player 100 also includes a network transceiver 105. LG-1006, ¶61. The “network transceiver 105 [is used] for interacting with a cellular network, such as a Global System Mobile

(GSM) network and the like via antenna 117.” *Id.*, ¶66. “*Media player 100 is able to access the Internet through the cellular network.*” *Id.*

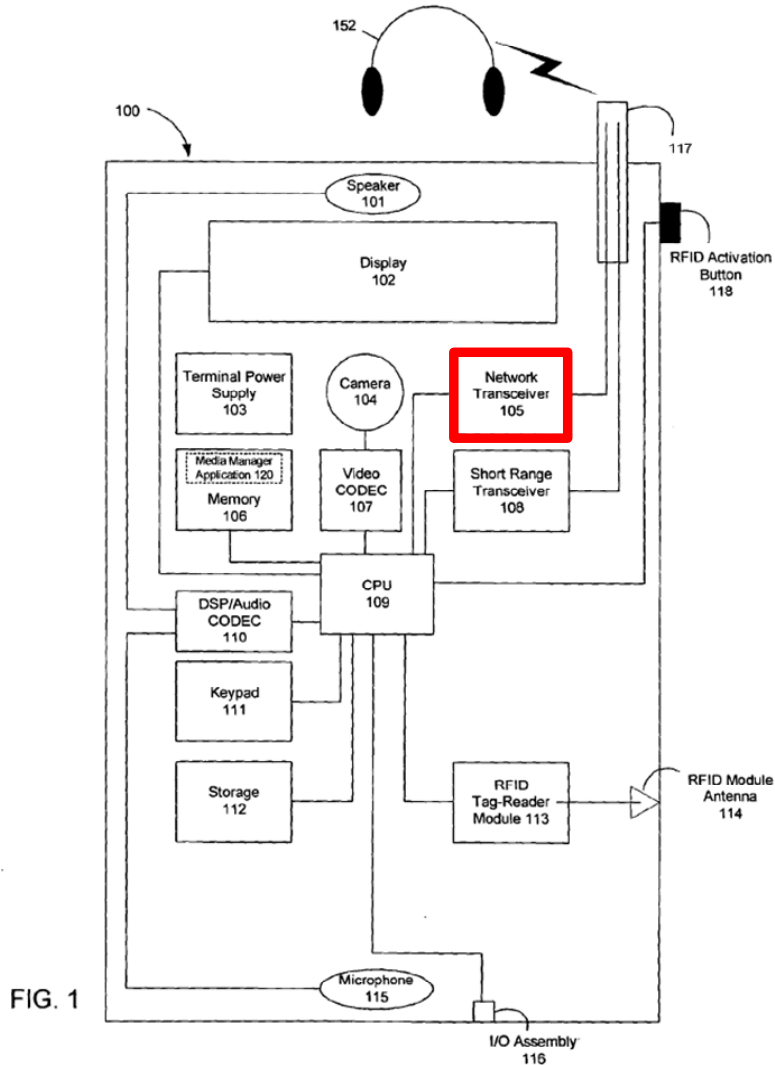


FIG. 1

LG-1006, FIG. 1 (annotated)

[18c] receiving digital information;

162. Dua-Barnes discloses or renders obvious receiving digital information (e.g., digital audio, video, email). For example, as discussed *supra* for [18b], Dua discloses receiving media content through the Internet, and re-transmitting that

digital media to an external device. It was obvious to a POSITA that such media content constitutes “digital information” because it is received from the Internet. *see also* LG-1006, ¶168 (“The ‘**Internet content**’ option could, for example, allow a user to **browse movie trailers** on his wireless media player 100, **select a movie for download**, pay for the movie, and use the media player 100 to re-transmit the selected movie to a television in the vicinity using the methods described herein.”); *id.*, ¶224 (explaining that the ‘Internet Content’ can include movies and **digital** music available for download); *id.*, ¶¶201 and 206 (explaining that media player 100B receives video/audio **digital content** recorded and transmitted by media player 100A); *id.*, ¶5 (“The standardization of file formats for a variety of media types and the resulting availability of processing support for these media types has allowed users to transfer and **share digital information between devices** more readily.”) *id.*, ¶57 (“media player [can be] dedicated to playing digital video.”). Barnes also discloses example digital content such as emails and downloadable audio and video that are transmitted to the user device through the Internet. LG-1007, ¶61 (“the contemporaneous wireless communication links of the present invention permits the user to participate in a conversation via a voice communication link (e.g., via a 3G, 2.5G, or 2G network) while simultaneously using a data communication link (e.g., via a WLAN, PAN, 3G, 2.5G, or 2G network) to **receive or send emails, transmit and receive data via the Internet,**

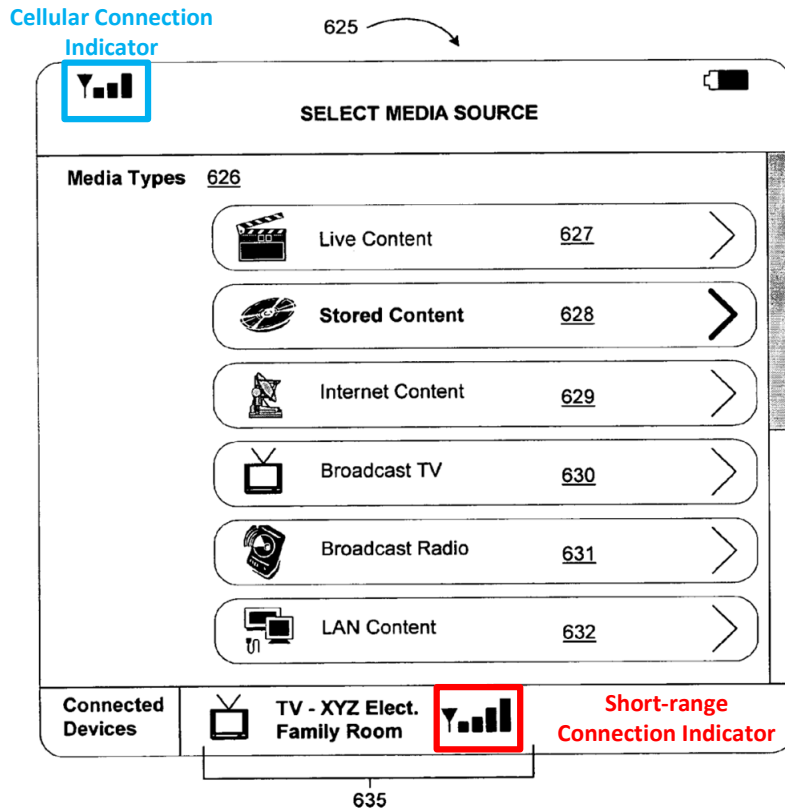
download audio or video files, upload and download data, or otherwise transmit and/or receive data.).

[18d] controlling each of the first and second radio communication circuits such that the first radio communication circuit transmits digital video information to the external apparatus and the second radio communication circuit connects to the internet or the home network simultaneously;

163. Dua-Barnes discloses or renders obvious controlling each of the first radio communication circuit (e.g., short-range transceiver 108) and second radio communication circuit (e.g., network transceiver 105) such that the first radio communication circuit (e.g., short-range transceiver 108) transmits digital video information (e.g., video file) to the external apparatus (e.g., external display or another media player) and the second radio communication circuit (e.g., network transceiver 105) connects to the internet or the home network (e.g., connects to the Internet through a cellular network) simultaneously.

164. In its Infringement Contentions, Patent Owner alleged that the claimed “simultaneous” controlling of the two connections is present in the accused device because “both icons” associated with the two connections are “available on the status bar” of the device’s display. LG-1012, 73 (“Similarly, upon information and belief, under certain conditions, cellular connections are preferred to provide MMS and E-mail services *to transmit video while simultaneously* the Wi-Fi communication chip is used to *connect to the Internet as*

shown by both icons being available on the status bar.”). Similarly, the media player 100 in Dua-Barnes presents an icon (blue in figure below) for the cellular connection, and another icon (red in figure below) for a short-range connection with an external device to send video content to that external device.



LG-1006, FIG. 15 (annotated)

165. More specifically, the figure represented above shows “a cellular network signal indicator” (blue) that indicates connection of the network transceiver 105 to the Internet (*see supra* [18b]) (*the second radio communication circuit connects to the internet or the home network*), and a short-range connection signal indicator (red) that indicates *simultaneous* connection of the media player

100 to a “peripheral” device (e.g., a particular TV as indicated by 635 in the figure) to facilitate transmission of video content to that peripheral device (*the first radio communication circuit transmits digital video information to the external apparatus*) (*see supra* [18a]). LG-1006, FIG. 12, ¶¶210-211, 213 (explaining that FIG. 12 shows a user interface for selecting an external device within the short-range communication of the media player 100 to send a video content to that device, and also noting that icon 601 shows an active connection to a cellular network: “FIG. 12 is an illustration of ***an exemplary user interface screen 600*** depicting ‘device profile’ categories, in accordance with one embodiment of the present invention.... ***Device profiles may exist for*** devices that can generally be classified as either media processing units or ***peripherals***. Media processing units include, for example, MP3 players, digital video players, PDAs, televisions, digital cameras, medical monitoring devices, printers, and copiers ***that are capable of receiving and processing media assets (e.g., video, audio, images, animation, presentations, text, etc.) transmitted from the media player 100***.... 603 is one example of a device category. The television category listing in 603 includes an icon that visually represents the category and a category name (e.g., Television). ***At the top left of the screen is a cellular network signal indicator 601***, and at the top right is a battery-life indicator 602 for the media player 100.”); *id.*, ¶222 (The screen 625 [in FIG. 15] ***shows at the bottom 635, all devices that are currently***

connected to the media player 100. In this illustration, the Connected Devices section indicates that there is *a TV connected to the media player 100.*”); FIG. 13, ¶215 (explaining media player’s detection of peripheral devices that are “within signal range,” which means within the short-range coverage of transceiver 108 of the media player 100). The presentation of the two icons (blue and red) at the same time indicates a simultaneous connections that is consistent with how Patent Owner applied limitation [18d] in its infringement contentions.

166. Barnes also notes that the user can transmit video content while receiving Internet content such as emails. LG-1007, ¶60 (“the user can also receive and *transmit live audio/visual data—such as live video transmissions* (e.g., a video telephone call, receive a television transmission, transmit video camera data), and live audio transmissions (e.g., a telephone call, receive radio transmission, transmit voice data)—*while also* transmitting and *receiving computer data such as emails*, word processing files, spreadsheet files, application files, and data to remote computer systems (e.g., such as a web page from a web server) and non-live audio/visual data (previously stored audio data and video data).”). It would have been obvious to a POSITA to receive emails through Internet. Thus, a Dua-Barnes device would be able to transmit video content through short range transceiver 108 (*see supra* [18a]) while being connected to the Internet through network transceiver 105 (*see supra* [18b]) to receive emails. *Id.*

167. The media player has a CPU 109 that controls the functionalities of both the short-range transceiver 108 and the network transceiver 105. LG-1006, ¶66 (“Short-range transceiver *108 interacts with a CPU 109 for implementing short-range communications protocols and processing messages exchanged between other electronic devices and the media player 100*. CPU 109 is linked to a volatile or dynamic random access memory (DRAM) 106. *CPU 109 executes programs* stored in a non-volatile or read only memory 106 and *provides instructions for managing and controlling the operating of media player 100*. *CPU 109 is also connected to network transceiver 105 for interacting with a cellular network*, such as a Global System Mobile (GSM) network and the like via antenna 117.”).

168. Therefore, Dua-Barnes renders obvious controlling each of the short-range transceiver 108 (*the first communication circuit*) and the network transceiver 105 (*the second communication circuit*) such that the short-range transceiver 108 transmits video content to the external device 751/851 (*the first communication circuit transmits digital video information to the external apparatus*) and the network transceiver 105 connects to the Internet (*the second communication circuit connects to the internet*) simultaneously.

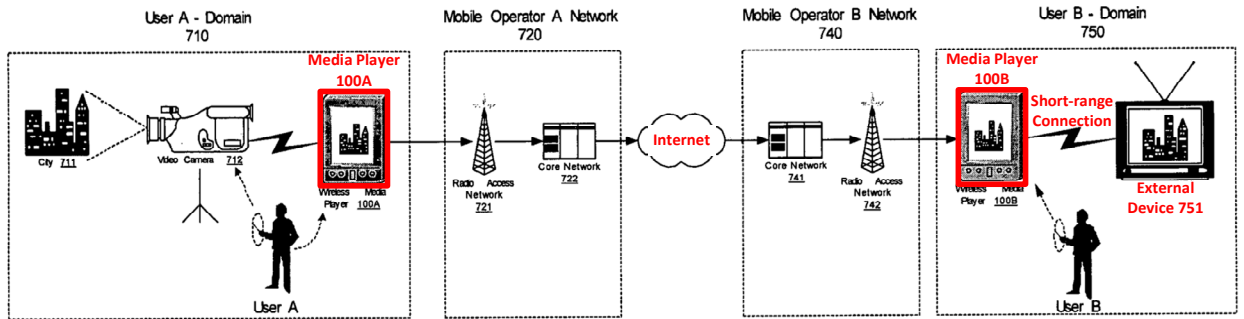
169. In addition, the Dua-Barnes combination goes even beyond simultaneous (i) video transmission through a first circuit and (ii) an Internet

connection through a second circuit, and render obvious *simultaneous reception and transmission* of the video content through the two connections. Thus, to the extent that it's argued that the '284 Patent discloses simultaneous transmission and reception of the video data (which it does not) as opposed to being limited to simultaneous video transmission and Internet connection, Dua-Barnes still render such feature obvious.

170. As discussed *supra* in section X.C.i, the media player 100 can receive media files from an external source and re-transmit the received file to an external device through a short-range connection. *see also* LG-1006, ¶168 (“The ‘Internet content’ option could, for example, allow a user to browse movie trailers on his wireless media player 100, ***select a movie for download***, pay for the movie, and use the media player 100 to ***re-transmit the selected movie to a television in the vicinity*** using the methods described herein.”); *id.*, ¶156 (“the user of media player 100 may decide that he wants to wirelessly transmit the incoming media to another electronic device to ***facilitate enhanced viewing, for example, on a large television with surround sound***. Alternatively, he may decide to ***share the incoming media with a friend in the vicinity*** that also has a wireless media player device.”).

171. Dua teaches a simultaneous video reception and re-transmission to an external display. For example, Dua recognizes that “***as User B watches the video***

feed from User A's media player 100A on his media player 100B, ***he may decide that he wants to watch the video feed on his television*** for an enhanced viewing experience and surround sound.” LG-1006, ¶195. FIGs. 10 and 11 of Dua, for example, convey that the media player 100B allows the user to *simultaneously connect to the Internet* to receive/download the video content from media player 100A and *transmit* the video content (*digital video information*) to the external device 751/851 (*to the external apparatus*). *see also* LG-1006, ¶224, FIG. 17 (showing selection of Internet content for download and re-transmission to an external device—i.e., “family Room TV.”); *id.*, ¶190 (“FIG. 10 is a functional diagram of a media player 100A wirelessly capturing a video feed from an external video recording device 712, and ***transmitting the same video content via a cellular network 720 and the Internet 730 to another media player 100B, which further transmits the content to a television 751***, in accordance with one embodiment of the present invention.”); *see also id.*, ¶201 (“FIG. 11 is a functional diagram of a media player with an integrated video camera 100A, filming a city scene 811, and transmitting video/audio content via a cellular network 820 and the Internet 730 to two separate media player devices 100B & 100C.”); *id.*, ¶204 (“The user B domain 850 is shown as such in order to exemplify that ***an incoming video feed*** can be separated so as ***to present the image portion of the feed on a television 851***, and the audio portion via a stereo 852 with surround sound.”).



LG-1006, FIG. 10 (annotated)

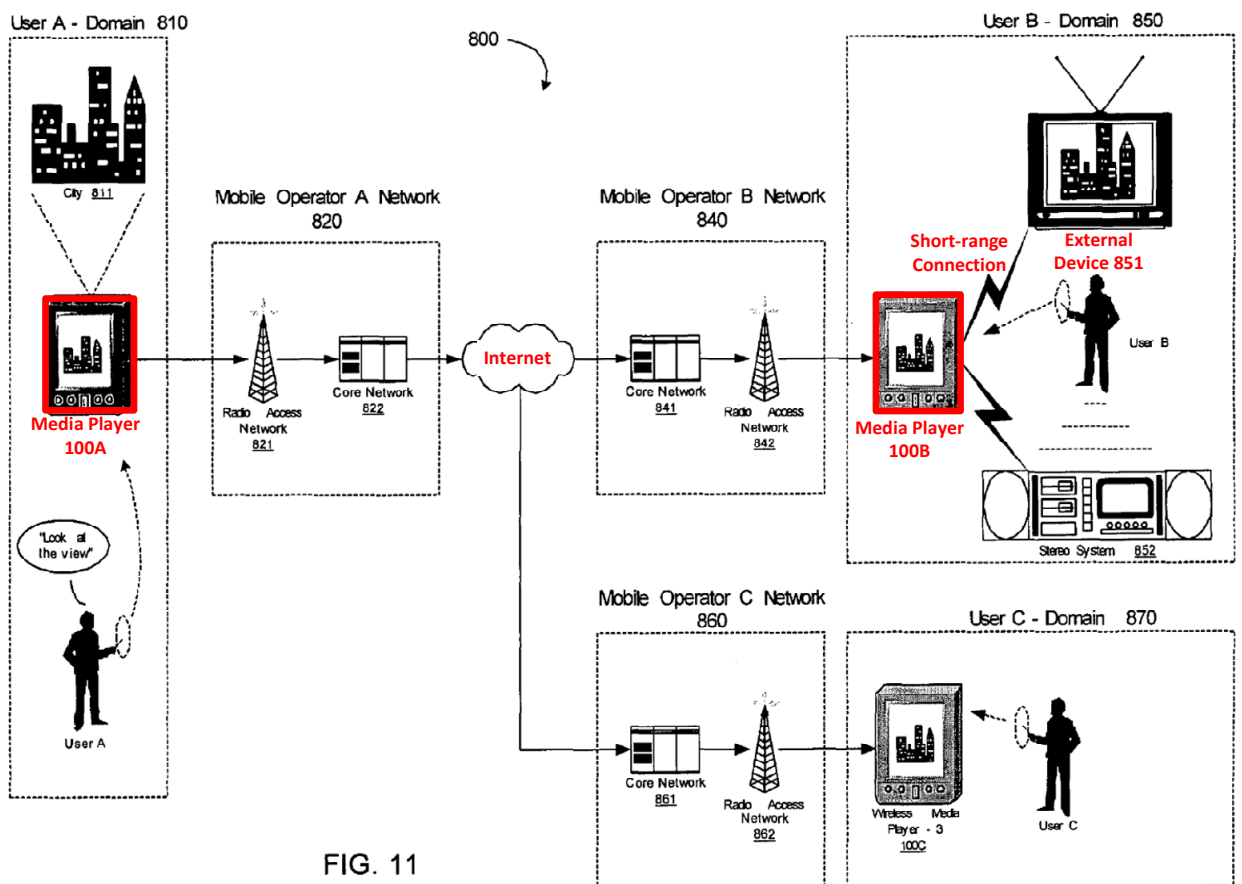


FIG. 11

LG-1006, FIG. 11 (annotated)

172. To the extent there is any disagreement on Dua’s explicitness in disclosing the *simultaneous* video reception and transmission, Barnes is clear on that point.

173. Barnes contemplates a “live” presentation of a video content (e.g., live broadcasting, a video chat) on an external display device, where the video is received on the user device and is “immediately” routed to the external display device for presentation. LG-1007, ¶¶60-61 (“*the user can[] receive and transmit live audio/visual data—such as live video transmissions (e.g., a video telephone call, receive a television transmission, transmit video camera data), and live audio transmissions (e.g., a telephone call, receive radio transmission, transmit voice data)—while also transmitting* and receiving computer data such as emails, word processing files, spreadsheet files, application files, and *data to remote computer systems*. ... The presentation of “live” audio/visual is meant to mean the process of *receiving an audio or video broadcast and immediately, or immediately* after processing (e.g., after storing), *presenting the audio and visual to the user on the* audio output device and/or *display device. The data that is received live may be transmitted as [being] captured from live events from the source* or may be transmitted from a previously stored audio/visual production and transmitted upon request by the user (e.g., a movie transmitted on demand).”); *see also id.*, ¶63 (“The communication module may also *route certain data to remote*

devices during live or non-live presentation to the user. For example, a *video transmission* or computer data (e.g., web pages) *received by the device 101 may be routed* (e.g., as requested by the user) to a remote display device (e.g., via a wireless PAN to a display in an automobile) that may be large or of better quality than the display.”).

174. It would have been obvious to a POSITA to use Barnes’ live video reception and transmission capability so that the user can get an enhanced (e.g., larger or better quality) presentation of the live content (e.g., a live football game, a video chat) on an external display device. Applying Barnes’ live video reception and transmission to Dua is nothing more than utilizing a familiar known technique in selecting video forwarding to achieve a predictable result of presenting the video on a larger, better quality, or just another display device.

175. A POSITA would have reasonably expected success applying Barnes’ suggestion to Dua given Dua’s teachings and Barnes’ contemplated live video reception/transmission.

176. Dua-Barnes’ live data reception and re-transmission constitute *connecting* to the external video source and *transmitting* the video content to the external device *simultaneously* because they are done to “enhance viewing” of an “internet content” or to “share the incoming media.”

177. It should be noted that it would still be obvious to a POSITA to select a proper connection for the video re-transmission to the external device for the reasons discussed *supra* X.C.i.

[18e] controlling assignment between the first radio communication circuit and the external apparatus, and assignment between the second radio communication circuit and the internet or the home network;

178. Dua-Barnes renders obvious controlling assignment (e.g., controlling connection-assignment) between the first radio communication circuit (e.g., short-range transceiver 108) and the external apparatus (e.g., external display or media player), and assignment (e.g., controlling connection-assignment) between the second radio communication circuit (e.g., network transceiver 105) and the internet or the home network (e.g., the internet).

179. As explained *supra* in section VII.A, given the additional limitation in this claim requiring control of the assignment such that one assignment is be *more than* the other, the '284 Patent suggests that an ***assignment between*** a radio communication circuit and an external apparatus or network means ***assigning particular connection parameter(s)*** to the connection *formed between* the communication circuit and the external apparatus or network, and the examples of such connection parameters include transmission rate/capacity, bandwidth, modulation scheme, and transmission schedule.

180. In its infringement contentions, however, Patent Owner uses the term “assignment” as assigning or making a connection by a radio communication circuit. More specifically, Patent Owner asserted that limitation [18e] constitutes “execut[ing] software *to control performing each one of the functions [made to form a connection] such as MMS/e-mail/connecting to the router/connecting to the Internet/Wi-Fi Direct.*” LG-1012, 82; *see, e.g., id.*, 22, 32, 50 for examples of the “functions” (“For example, the following screenshots show each of the 284 Accused Products using a Wi-Fi communication chip to transmit information by using one or more of MMS and/or Wi-Fi Direct (similar *functionality* also applies to E-mail over Wi-Fi”); *id.*, 32 (“For example, the following screenshots show exemplary 284 Accused Products using a cellular communication chip to transmit digital video information via MMS and similar *functionality* also applies to transmitting digital video via e-mail”). Patent Owner alleged that the asserted product meets limitation [18e] because the asserted product has the “*ability to transmit an indication to turn the Wi-Fi and cellular communication chips on/off and assign a connection accordingly.*” *Id.*, 82; *see also id.*, 82-84 (showing the indicators that represent turning respective WiFi, cellular, and Bluetooth connections on/off on the accused product).

181. In light of the foregoing, it appears that the Patent Owner’s position is to constitute “controlling assignment between the first radio communication circuit

and the external device” as **assigning a connection to** the first radio communication circuit **by making the connection** between the first radio communication circuit and the external device for the purpose of transmitting content (e.g., video information). Similarly, based on the Patent Owner’s contentions, “controlling assignment between the second radio communication circuit and the internet or the home network” constitutes **assigning an internet connection** to the second radio communication circuit **by connecting** the second radio communication circuit **to the internet** for the purpose of transmitting information.

182. Without conceding to the appropriateness of Patent Owner’s position, and solely to make sense of the claim language based on the Patent Owner’s contentions, it appears that the assignment and making a connection (i.e., *controlling the assignment*) under the Patent Owner’s contentions can be as simple as activating such connections.

183. Even if that was an appropriate construction of “assignment,” assigning a connection is nothing more than assigning parameters associated with that connection because a connection is not separate from its parameters. Indeed, the ’284 Patent, too, recognizes that a connection is not separate from its parameters. In preparation for a video transmission, the Patent assigns a particular connection “scheme” to the modem (i.e., *radio communication circuit*) responsible

for the video transmission, where a scheme is nothing other than the connection parameters. “For example, in a situation wherein the user issues an indication to *transmit video information by radio via the modem 1002* to the display apparatus 200 while acquiring information from the Internet according to scheme 1 of FIG. 9 by use of the modem 1003, the controller 132 *outputs a control signal to the assignment controller 1001 such that the transmission scheme of the modem 1003 is changed from scheme 1 to scheme 2 of FIG. 9 and that of the modem 1002 is set to scheme 1 of FIG. 9* conduct communications.” LG-1001, 8:38-47.

SCHEME	SCHEME 1	SCHEME 2
BANDWIDTH	6MHz	6MHz
CARRIER MODULATION SCHEME	64QAM	QPSK
CONVOLUTION CODE	3/4	2/3
GUARD INTERVAL	1/8	1/8
TRANSMISSION CAPACITY	17Mbps	5Mbps

LG-1001, FIG. 9

184. The connection schemes presented in FIG. 9 are defined by respective *connection parameters* including bandwidth, carrier modulation scheme, and transmission capacity/rate. Therefore, assigning a connection to a communication circuit (as pursued by the Patent Owner) constitutes assigning a connection scheme

(as presented in the Patent), which means assigning each parameter associated with that scheme (e.g., assigning transmission rate) to that communication circuit.

185. Dua-Barnes, renders obvious such connection assignment controlling feature.

186. Dua discloses controlling a connection-assignment to the short-range transceiver 108 (*the first radio communication circuit*) by making a connection between the media player 100 and an external device when that external device gets within the short-range coverage of the media player 100. *See e.g., LG-1006, ¶20* (The invention [includes] a method of creating, storing, and accessing profiles for target devices that have previously exchanged communication settings, media processing capabilities, and other information with the media player. Profiles can be used *to establish automatic connectivity between the media player and one or more target devices that are in proximity via a common short-range wireless communication protocol*. The method includes, receiving device information, communication settings, media processing capabilities, and other parameters associated with the target device and using the information to establish a profile for the target device on the media player. *The device profile can be enabled at the user's option to automatically detect the target device when within a certain proximity to the media player. At that point wireless connectivity between devices can be automatically established. Alternatively, the profile could also be used to*

manually establish wireless connectivity with a target device at the user's discretion."); *see also id.*, ¶139 (regarding device profile creation and use). Since the short-range transceiver 108 is in charge of the short-range communications with external devices (*see supra* [18a]), a POSITA would have found it obvious that the short-range connection is formed (or is offered to be formed) between the short-range transceiver 108 and the external device when the external device is within the "proximity" of the media player. And as explained above, the formation of such connection constitutes *assigning the connection* (and thus, the connection parameters) between the short-range transceiver 108 (i.e., the first radio communication circuit) and the external device. *Id.*

187. As discussed above, a connection assignment constitutes assigning connection parameters. As discussed *supra* in X.C.i, a POSITA would have recognized to assign a connection with higher "speed" to for video transmission in the Dua-Barnes device. Such assignment is in line with the '284 Patent's particular example with respect to its FIG. 9, where scheme 1 with higher transmission capacity (i.e., speed) is assigned to modem 1002 designated for the video transmission. *see also* LG-1001, 8:38-47 (describing this example assignment for video transmission through modem 1002); *id.*, 8:24-27 ("As can be seen from FIG. 9, the transmission capacity of scheme 1 is 17 Megabits per second (Mbps) which is more than three times that of scheme 2 (5 Mbps).").

188. Similarly, Dua discloses controlling a connection-assignment to network transceiver 105 (*the second radio communication circuit*) by making an internet connection to the transceiver 105 to receive digital information (e.g., digital video, audio). LG-1006, ¶66 (“***CPU 109 is also connected to network transceiver 105 for interacting with a cellular network***, such as a Global System Mobile (GSM) network and the like via antenna 117. ***Media player 100 is able to access the Internet through the cellular network.***”); *id.*, ¶¶ 67-68 (discussing media player’s compliant with cellular and internet protocols to transmit content); *see also supra* [18b] (explaining connectivity of the network transceiver 105 to the Internet).

189. The CPU 109 (*see supra* [18d]) of the media player in Dua-Barnes controls the functionalities of both the short-range transceiver 108 and the network transceiver 105, including controlling the connection assignment to those transceivers. LG-1006, ¶66. Therefore, in Dua-Barnes combination, the CPU 109 controls the connection-assignment (*controlling assignment*) for the connection between the short-range transceiver 108 and an external device (*between the first radio communication circuit at the external apparatus*) and the connection-assignment between the network transceiver and the Internet (*and the assignment between the second radio communication circuit and the internet*) by forming the connection (*controlling assignment*) between the short-range transceiver 108 and

the external device, and forming the internet connection by the network transceiver
105.

[18f.1] controlling the assignment such that the assignment between the first radio communication circuit and the external apparatus is prioritized⁴ more than the assignment between the second radio communication circuit and the internet or the home network

190. Dua-Barnes renders obvious controlling the assignment (e.g., controlling the connection-assignments) such that the assignment between the first radio communication circuit and the external apparatus is (prioritized) *more than* (e.g., has a higher priority for transmitting video than) the assignment between the second radio communication circuit and the internet or the home network.

191. As discussed *supra* for [18f.1] under Ground I, giving an “assignment” to a first connection “*more than*” an “assignment” to a second connection means giving a “*higher priority*” to the connection parameters of the first connection as compared to the connection parameters of the second connection. *See supra* for [18f.1] under Ground 1 citing LG-1001, 2:13-19, 2:32-36, 12:43-51. It was also discussed in the same section *supra* that Patent Owner appears to construe assigning to a first connection “*more than*” to a second

⁴ Added in a Certificate of Correction with no examination post Issuance of the Patent.

connection to mean “**prioritizing**” the first connection to the second connection *for the purpose of video transmission*. See *id.*; LG-1012, 85-102 (explaining Patent Owner’s position with respect to limitation [18f.1]).

192. Dua-Barnes renders obvious controlling the connection-assignment such that the assignment between the first radio communication circuit and the external apparatus is (prioritized) **more than** (i.e., has a higher priority for transmitting video content than) the assignment between the second radio communication circuit and the internet.

193. By the priority date of the ’284 Patent, it was well-known that transmitting video (particularly live video) clips require a high bandwidth and high transmission rate, for example, to avoid interruption in watching the video. (citing to LG-1013, ¶¶ 3, 21 and LG-1014, ¶118). Further, as discussed *supra* in section X.C.i, in Dua-Barnes, the media player assigns (or prioritizes) a connection with a higher bandwidth/transmission data rate for video transmission, for example, to reduce buffering and streaming interruptions at the destination device. *Id.*; LG-1007, ¶66 (***If the user desires to download and watch a movie*** (which may [be] determined by a user input in response to a prompt or by the user opening an audio/video player for external retrieval of the video file), ***relatively high bandwidth can be anticipated as being needed***. Since the [hypothetical] WLAN does not provide enough bandwidth ***to receive the communication (e.g., movie***

*data file) in a desired manner without buffering, the higher speed network is selected. ...Thus, in this example embodiment *the programmed rules will be based on bandwidth availability (anticipated, current).*”).*

194. It would have been obvious to a POSITA to use the transceiver (from among transceivers 105 and 108 in Dua-Barnes) that supports the higher bandwidth/transmission rate for video transmission to the external device (e.g., to a peripheral display). Dua recognizes video transmission constraints, and notes that “[t]he *short-range transceiver 108* and antenna system 117 are *specially designed to support the widest array of communication protocols and broadcast standards*,” which suggests assigning the highest available short-range bandwidth to the connection between transceiver 108 and the external device. LG-1006, ¶63. Dua reinforces this suggestion by requiring the receiving display device (e.g., an external TV) to have a transceiver that supports “high bandwidth communication with other devices (such as the media player 100).” LG-1006, ¶215.

195. Further, by the priority date of the ’284 Patent, it was well-known that cellular networks generally have lower bandwidth (especially on the uplink) compared to local area networks (that provide short-range communications). *see also* LG-1018, 313 (“*wide area cellular networks will generally have lower bandwidth capabilities and higher costs than that of wireless local area networks (LANs)*). Wireless LANs are expected to be deployed only in public ‘hot spots’ and

be available in office and home environments whilst cellular networks will tend to have universal coverage with the broader band access initially being available in high-density areas.”); LG-1007, ¶65 (“available bandwidth of each available network [constitutes] the amount of data that can be communicated over a given time period [through that network].”). Therefore, a POSITA would have been motivated to *prioritize using* Dua-Barnes’ *short-range transceiver 108* over cellular network transceiver 105 *for transmitting video content* from the media player to a local peripheral device (e.g., within the vicinity of the media player) because (i) transceiver 108 supports the widest available short-range bandwidth, (ii) the peripheral device (e.g., an external TV) supports high-bandwidth transmissions for receiving the video content, and (iii) the short-range transceiver 108 was known to provide a higher bandwidth for a local network connection (e.g., WiFi, Bluetooth) than the cellular network transceiver 105 would. And as discussed earlier, such prioritization constitutes assigning “*more*” to the connection between the short-range transceiver 108 (*the first radio communication circuit*) and the external device *than* to the connection between the network transceiver 105 (*the second radio communication circuit*).

[18f.2] [controlling the assignment such that the assignment between the first radio communication circuit and the external apparatus is more than the assignment between the second radio communication circuit and the internet or the home network] when a user issues an indication to transmit digital video

information by the first radio communication circuit while acquiring information from the internet or the home network by the second radio communication circuit.

196. Dua-Barnes renders obvious controlling the assigning “more” limitation [18f.1] when a user issues an indication (e.g., selects a transmission button 186/675) to transmit digital video information by the first radio communication circuit (e.g., when a user selects the transmit button 186/675 as a conclusion of a set of selections made for transmission of a video content to a particular peripheral device through short-range transceiver 108) while acquiring information from the internet or the home network by the second radio communication circuit (while acquiring information from the internet by network transceiver 105).

197. In their infringement contentions, the Patent Owner applied the claimed user indication broadly to cover an indication that implies a selection of an (asserted) first radio communication circuit rather than the user’s explicit selection of the first radio communication circuit. Below are a few examples of how Patent Owner asserted the user indications on the accused product:

when a user indicates to transmit using ‘Wi-Fi Direct’ while acquiring information from the Internet using a cellular connection (e.g., the user issues a ‘Wi-Fi Direct’ transfer request while a song is downloading in background over cellular connection or the user is using cellular data services), the controller (e.g., CPU) of each of the 284 Accused Products executes software to prioritize

using the Wi-Fi communication chip for Wi-Fi Direct instead of using cellular services.

LG-1012, 86.

*As an additional example, when a user indicates to turn Wi-Fi on while acquiring information from the Internet using a cellular connection (e.g., **the user turns Wi-Fi on** while a song is downloading in background over cellular connection **or the user selects a particular Wi-Fi network** while using cellular data services), **the controller** (e.g., CPU) of each of the 284 Accused Products **executes software to prioritize using the Wi-Fi communication chip over the cellular connection for receiving a video** (e.g., via MMS or email).”*

Id., 88-89.

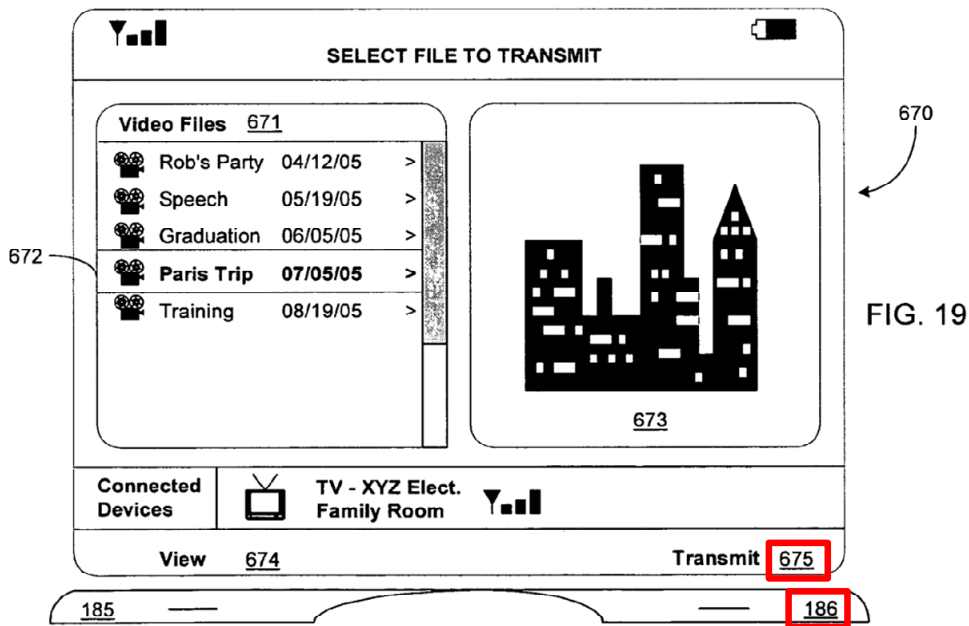
*For example, upon information and belief, **when a user indicates to turn cellular data on** while acquiring information from a home network (e.g., the device is connected to a network router where the router is not connected to the Internet but is communicating with the device), the controller (e.g., CPU) of each of the 284 Accused Products executes software to prioritize using the cellular communication chip over Wi-Fi **for transmitting a video** (e.g., via MMS or e-mail).*

Id., 95. While I do not concede to the appropriateness of the Patent Owner’s use of this claim limitation in their infringement contentions, I note that under Patent Owner’s interpretation of the user indication, the user makes selections—such as issuing a ‘Wi-Fi Direct’ transfer request, turning Wi-Fi or cellular data on, or selecting a particular WiFi network—that only *imply* using the first communication circuit—e.g., merely turning on cellular, but not selecting a specific radio or

merely indicating the application or the Wi-Fi communication protocol, but not the specific radio (2.4GHz WiFi radio or 5GHz WiFi radio)—for the video transmission, and it is the controller that selects the communication chip/circuit—e.g., by “execut[ing] software to prioritize using the Wi-Fi communication chip over the cellular connection for receiving a video.” *Id.*

198. Similarly, Dua-Barnes render obvious limitation [18f.2] because the user selects the video to be transmitted, and the connection to be used for such transmission, which implies indicating the communication circuit that facilitates that connection.

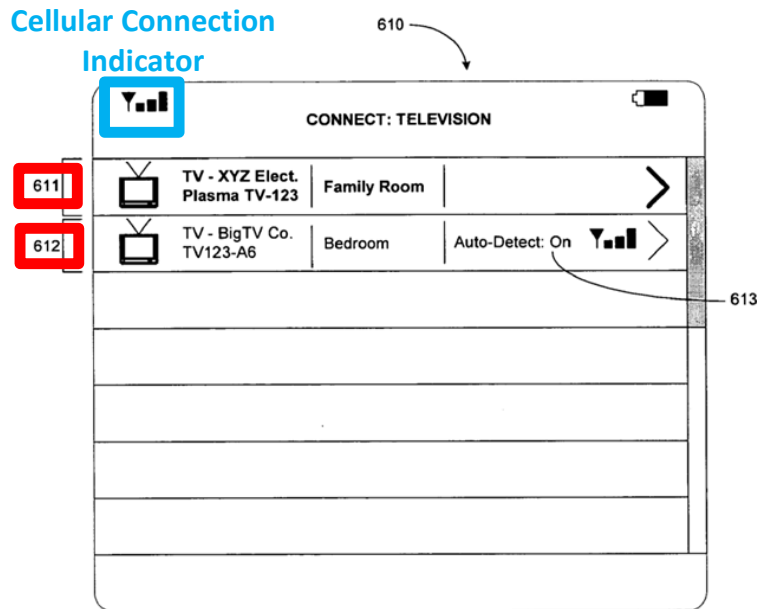
199. In its FIGs. 12-19, Dua provides details on a set of selections that a user makes to (i) choose a peripheral device to connect to through the short-range transceiver 108, and (ii) a video content for short-range transmission to the selected peripheral device. LG-1006, ¶¶12-50. Once the user has made the set of selections, pressing a final “transmit” button 186/675 (*user indication*) initiates transmission of the video content to the peripheral device. LG-1006, ¶227. The following paragraphs further explain the set of selections and the user’s final transmission indication.



LG-1006, FIG. 19 (annotated)

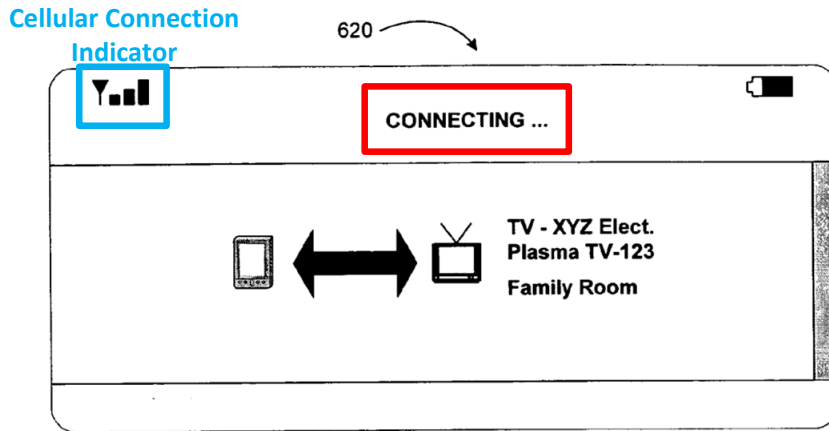
200. *First*, the user in Dua selects (from a list of device profiles,) the external device that is to be connected to the media player through the short-range transceiver 108. A device profile is a record of the properties of an external device created and stored on the media player. LG-1006, ¶163; *see also supra* section IX.E. “Device profiles allow users to connect to the same device in the future either automatically [or] *manually by selecting the profile from a list (and when within range of the device’s RF signal).*” *Id.* In FIG. 13, for example, device profile 611 can be selected to transmit a video content to an external television (“TV-XYZ Elect.”) when the television is detected within the short-range transmission of the media player. *Id.*, ¶¶163, 215. In other words, the user selects the external device when it is within the “vicinity” of the user’s media player, for

example, “to facilitate enhanced viewing” of a video content. LG-1006, ¶¶156, 163, 215. While this is an implicit indication of the radio, an explicit indication of the radio is also disclosed in Dua’s “normal” technique, which I explain further below.



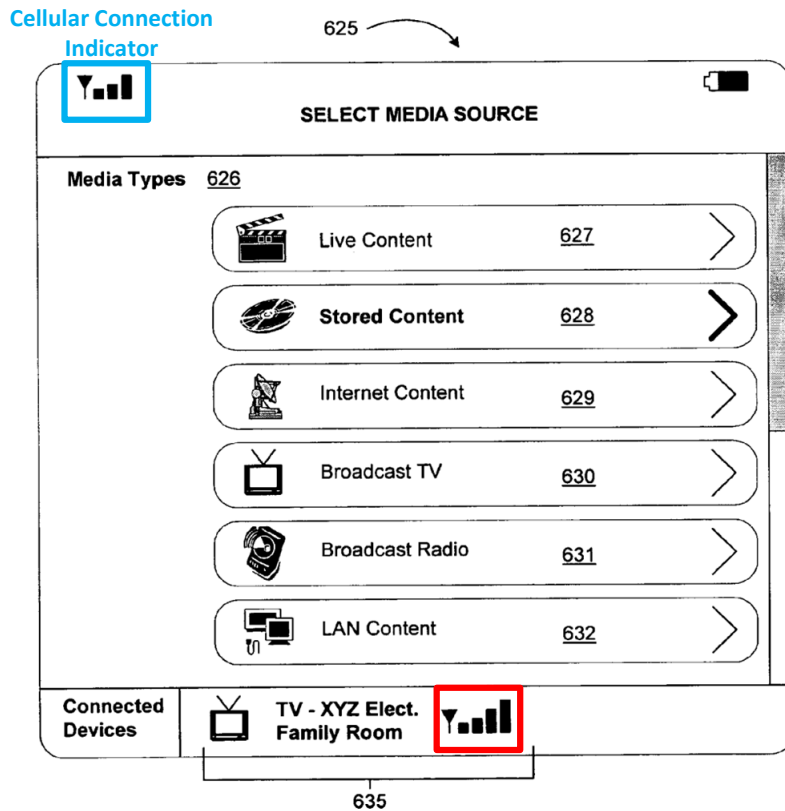
LG-1006, FIG. 13 (annotated)

201. Once the user selects the external device’s profile, a connection is formed between the media player and the external device. LG-1006, ¶220. FIG. 14 “is an illustration of an exemplary user interface screen 620 depicting messaging that indicates that the media player 100 is wirelessly connecting to [the selected external] device.” *Id.* The connection in process is illustrated below in red, and the cellular connection indicator is highlighted in blue (see supra [18d]).



LG-1006, FIG. 14 (annotated)

202. Once the media player is connected to the external device, the connection is depicted by a new signal indicator (shown in red below) in addition to the already existing cellular connection indicator (blue) on the media player's user interface.



LG-1006, FIG. 15 (annotated)

203. Since the new (red) signal indicator is added only after media player's connection to the external device (*see* FIGs. 13-15 above), and since the new indicator is presented in addition to the cellular signal indicator (blue), a POSITA would have recognized that the connection to the external device is other than the cellular connection, and thus, is a short-range connection formed by the short-range transceiver 108.

204. Alternatively, it would have been obvious to a POSITA to explicitly indicate the desired radio associated with the short-range transceiver 108 (*first radio communication circuit*) of the media player for transmitting the video content

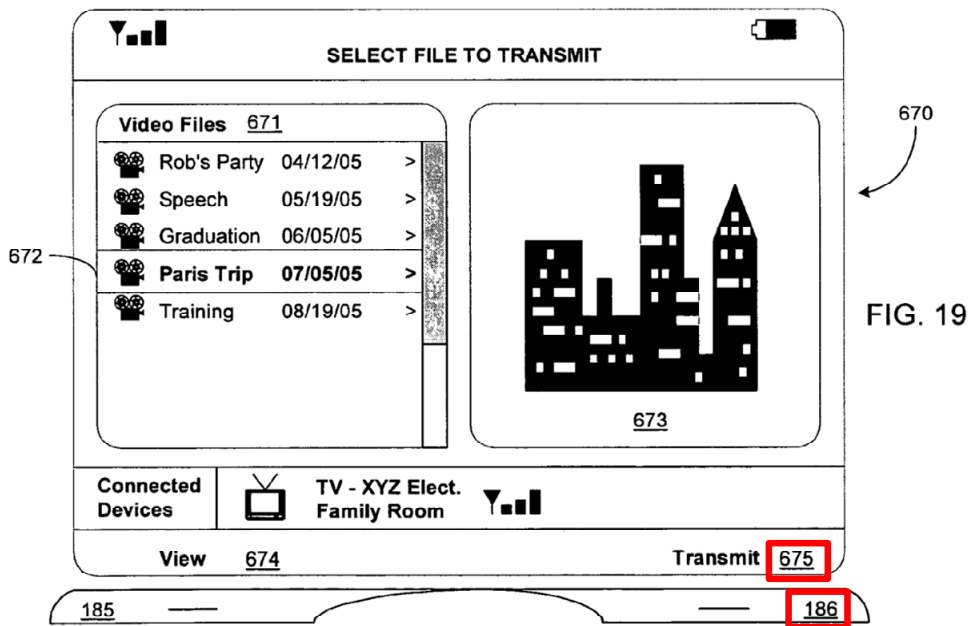
to the selected external television because the user makes such selection when the media player is in the vicinity of the television—i.e., “within range of [the external] device’s RF signal.” (citing LG-1006, ¶163); *see also* LG-1006, ¶218 (noting that the connection would be “*dropped*” upon “*leaving the RF coverage area*” of the external device, which further reinforces that the connection to the external device is through a short-range connection). Indeed, a POSITA would have been motivated to use the short-range transceiver 108 for such transmission because of the constraints in video transmission discussed *supra* in [18f.1], and the higher bandwidth and speed that the short-range transceiver 108 provides as compared to the network transceiver 105 (*see supra* [18f.2]). Additionally, if a device had multiple short-range transceivers, it would have been obvious to a POSITA to indicate a specific short-range transceiver since different radios have different benefits and drawbacks. For example, an ultra-wideband radio may have a higher data rate than a Bluetooth radio. Or the Bluetooth radio may be experiencing interference from other devices and is thus not preferred.

205. Thus, Dua-Barnes renders obvious that a user issues an indication to transmit by the first radio communication circuit (i.e., short-range transceiver 108) while being connected to the internet by the second radio communication circuit (i.e., network transceiver 105).

206. **Second**, the user selects the video content that the user wants to send to the selected external device (that is connected to the short-range transceiver 108). “Upon establishing wireless connectivity with the target device, the media player 100 prompts the user to select the content source from which he wants to select a media asset to transmit to the target device.” LG-1006, ¶165; *see also id.*, ¶171 (discussing that the media player shows the user only the media contents the selected external device can handle); *id.*, ¶168 (the media asset can be selected from Internet content, where the “[t]he 'Internet content' option could, for example, allow a user to browse movie trailers on his wireless media player 100, select a movie for download, pay for the movie, and use the media player 100 to re-transmit the selected movie to a television in the vicinity.”); FIG. 19, ¶226 (“FIG. 19 is an illustration of an exemplary user interface screen 670 depicting ‘Video Files’671 that can be selected for transmission to [the] target device.”).

207. **Third**, the user selects a transmission button 675/186 (*user indication*) to initiate transmission of the user’s selected video content to the selected peripheral device connected to the user device through the short-range connection. In FIG. 19 (below), for example, “[i]f the user decides to transmit the [selected] file 672 to [the selected] target device in accordance with the invention, he may simply press the right menu selection button 186 on the media player 100.” LG-1006, ¶227. Since “the media player 100 is connected to the target device,

pressing the right menu selection button 186, will initiate transmission [of the selected video file 672] to the target device.” Id.; see also id., ¶78 (“Contained in the keypad interface 195 at the bottom are two buttons 185 & 186 used for selecting options that appear directly above the respective buttons in display screen 102 and graphical user interface (known sometimes as ‘soft keys’).”).



LG-1006, FIG. 19 (annotated)

208. Therefore, by selecting the button 186//675 in Dua-Barnes, the user *issues an indication to transmit* the selected video content (*digital video information*) to a selected external device that is connected to the user’s media player, which implicitly indicates the radio connection through the short-range transceiver 108 (*the first radio communication circuit*) as explained above.

209. The above-explained process is in line with the Patent Owner's interpretation of the user indication as an indication that implies the selection of the short-range transceiver 108 (e.g., by selecting "a particular WiFi network" or turning "WiFi on" to imply using a specific WiFi radio). LG-1012, 88-89. This is because the user's selection of the destination device for short-range communication in Dua-Barnes implies using the short-range transceiver 108 (when there is only a single such transceiver or if a specific radio is associated with a destination device), and thus, renders obvious the claimed user indication per the Patent Owner's interpretation.

210. Alternatively, Dua-Barnes in light of the knowledge of a POSITA renders obvious the user's selection of Bluetooth as a short-range connection for the video transmission. Dua notes that the media player 100 can connect to a peripheral device (e.g., a headset or display) through a "normal Bluetooth session set-up procedure" rather than through Dua's "improved method... for wirelessly connecting these devices." LG-1006, ¶¶10, 123. By the priority date, it was well-known that a "normal Bluetooth session set-up procedure" involved the user's selection of the item to be transmitted, the Bluetooth (as the selected form of communication), and the destination device. *See, e.g.*, LG-1010, 85-86; LG-1005, 29; LG-1011, 1168, 1199-1200. Since in Dua-Barnes the Bluetooth connection is facilitated by the short-range transceiver 108 (LG-1006, ¶62), the explicit selection

of video content and Bluetooth as the chosen connection for transmission of the video content renders obvious the claimed user “*indication to transmit digital video information by the first radio communication circuit.*” Therefore, the Dua-Barnes combination in view of the well-known knowledge in the art renders the claimed user *indication* obvious.

1) Ground 2A

211. To the extent a POSITA would seek details for a normal Bluetooth set-up process (as suggested by Dua), the POSITA could turn to the teachings of N95 as an example reference in the same field of technology—i.e., wireless communications—as Dua. As discussed *supra* in section X.A.i, N95 explains that to transmit an item (e.g., a video) through Bluetooth, the user has to select the item, as well as Bluetooth as the chosen form of communication for transmitting the item. LG-1005, 29; *see also supra* section X.A.i. For the reasons discussed above (in Ground 2, [18f.2]), such selections render obvious the claimed user indication.

212. A POSITA would have been motivated to apply N95’s Bluetooth set-up process to Dua-Barnes because (i) Dua discloses the normal Bluetooth session set-up process to set a short-range communication, (ii) user’s involvement in setting a Bluetooth session was well-known and well-practiced, for example, because of the security concerns discussed *supra* in section X.A.i, and (iii)

applying a Bluetooth session set-up according to N95 is nothing more than utilizing a familiar known technique in selecting a radio connection to achieve a predictable result of improving security in connecting to reliable or known external devices rather than allowing a purely automatic Bluetooth connection with any external device. *See supra* section X.A.i. A POSITA would have reasonably expected success incorporating N95’s Bluetooth connection procedure into Dua-Barnes given Dua’s teachings, N95’s practical application as a user device capable of forming short-range communications, and the well-known practice of requiring a user selection for Bluetooth connections.

213. Dua-Barnes (alone or in view of N95) render obvious the rest of limitation [18f.2] as well. Dua discloses receiving the user indication (e.g., the user selection of button 186/675) *while acquiring information from the internet by the second radio communication circuit*. As discussed earlier, Dua provides the opportunity for the user to “wirelessly ***transmit the incoming media*** to another electronic device to facilitate enhanced viewing, for example, on a large television with surround sound, or to ***share the incoming media*** with a friend in the vicinity that also has a wireless media player device.” LG-1006, ¶156; *see also id.*, ¶168 (“a user [can] browse movie trailers on his wireless media player 100, ***select a movie for download***, pay for the movie, and ***use the media player 100 to re-***

transmit the selected movie to a television in the vicinity.”). Barnes discloses a similar scenario, where “*video transmission* or computer data (e.g., web pages) *received by the device 101 may be routed (e.g., as requested by the user) to a remote display device* (e.g., via a wireless PAN to a display in an automobile) that may be large or of better quality than the display of the device.” LG-1007, ¶63; *see also id.*, ¶60 (“the user can also *receive and transmit live audio/visual* data—such as live video transmissions (e.g., a video telephone call, receive a television transmission, transmit video camera data)...—*while also transmitting and receiving computer data such as emails*, word processing files, spreadsheet files, application files, and data to remote computer systems (e.g., such as a web page from a web server) and non-live audio/visual data (previously stored audio data and video data).”). The “incoming media” discussed in Dua, and the video, email, or other computer data discussed in Barnes constitute “*acquiring information from the internet.*”

214. Therefore, Dua-Barnes combination renders obvious that a user issues an indication (e.g., user’s selection of the transmit button) to transmit digital video information by the first radio communication circuit (e.g., to an external device in the vicinity of the media player) while acquiring information from the internet or the home network by the second radio communication circuit both in light of

Patent Owner's broad interpretation of this limitation as well as Dua's disclosure of a "normal" manual configuration that was well known to a POSITA.

215. It would have been obvious to a POSITA that Dua-Barnes' prioritization of the short-range transceiver 108 over the (cellular) network transceiver 105 to transmit the video content (i.e., limitation [18.f.1] per Patent Owner's contention) happens *when* the user submits such indication (limitation [18f.2]). This is because prior to the user's indication, no video is selected for transmission/sharing, and thus, no prioritization of the two transceivers would be needed for the purpose of sending the video content.

iii. Claim 19

[19] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in frequency bandwidth.

216. Dua-Barnes (alone or combined with N95) in view of the knowledge of a POSITA by the priority date renders obvious the first radio communication circuit (e.g., short-range transceiver 108) and the second radio communication interface (e.g., network transceiver 105) are different from each other in frequency bandwidth (e.g., WiFi bandwidth vs. GSM bandwidth).

217. The short-range transceiver 108 in Dua can operate on different short-range communication protocols such as IEEE 802.11g, Bluetooth, etc. LG-1006,

¶¶62, 66. The network transceiver 105, on the other hand, works with “a cellular network, such as Global System Mobile (GSM) network and the like.” *Id.*, 66.

218. By the priority date of the '284 Patent, it was well-known that short-range communication protocols operate on different frequency bandwidths and modulation/demodulation schemes than cellular networks do. Examples of these differences are provided in the table below:

Communication Protocol	Modulation Scheme	Frequency Band	Bandwidth
Bluetooth	GFSK/ $\frac{\pi}{4}$ DQPSK/8DPSK	2400-2483 MHz	1MHz
WLAN	CCK/DSSS/OFDM	2.4 GHz (under IEEE 802.11g)	20MHz
GSM	MSK	824-894 MHz 1850 – 1900MHz	200KHz

LG-1011, 195 (Bluetooth); LG-1016 26, 46-48; LG-1017, FIG. 1, ¶28 (WLAN); LG-1017, ¶31 (GMS).

219. Therefore, a POSITA would have recognized that in Dua-Barnes, the short-range transceiver 108 (*first radio communication circuit*) and the network transceiver 105 (*second radio communication circuit*) operate using different frequency bandwidths (*are different from each other in frequency bandwidth*).

iv. Claim 20

[20] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in modulation/demodulation method.

220. Dua-Barnes (alone or combined with N95) in view of the knowledge of a POSITA by the priority time renders obvious the first radio communication circuit (e.g., short-range transceiver 108) and the second radio communication interface (e.g., network transceiver 105) are different from each other in modulation/demodulation method.

221. As presented in the table above (*see supra* [19]), by the critical date of the '284 Patent it was well-known that WLAN uses CCK/DSSS/OFDM modulation scheme while GSM uses MSK modulation scheme. Therefore, a POSITA would have recognized that in Dua-Barnes, the short-range transceiver 108 (*first radio communication circuit*) and the network transceiver 105 (*second radio communication circuit*) use different modulation schemes (*are different from each other in modulation/demodulation method*).

D. Grounds 2B, 2C, and 2C(a)

i. Dua-Barnes (alone or combined with N95) in view of Kao, Bluetooth-Specification, or IEEE 802.11g

222. While the specifics of short-range communication protocols such as Bluetooth and WLAN are inherent to those connections, and thus, claims 19 and 20 are obvious over Dua-Barnes or Dua-Barnes-N95, to the extent that a POSITA

would need to search for such specifics, the POSITA would have looked into the references that recite those specifics. Examples of those references are Bluetooth Specification (LG-1011), IEEE 802.11g (LG-1016), and patent application publications such as Kao for WLAN and GSM specifics.

ii. Ground 2B: Claims 19 and 20 are Obvious Over Dua-Barnes in view of Kao

223. As noted supra in section IX.G, Kao lists a few wireless communication standards and their connection parameters. For example, Kao notes that WLAN uses 20MHz bandwidth and OFDM (Orthogonal Frequency Division Multiplexing) with PSK and/or QAM modulation schemes under the IEEE 802.11g standard, and GSM uses 200KHz bandwidth and MSK (Minimum Shift Keying) modulation scheme. LG-1017, FIG. 1, ¶¶28, 31.

224. Therefore, Dua-Barnes in view of Kao render obvious that the short-range transceiver 108 (*first radio communication circuit*) using WLAN, and the network transceiver 105 (*second radio communication circuit*) using GSM, use different frequency bandwidths (*are different from each other in frequency bandwidth (Claim 19)*), and use different modulation schemes (*are different from each other in modulation/demodulation method*) (**Claim 20**).

iii. Ground 2C: Claims 19 and 20 are Obvious Over Dua-Barnes in View of Kao and Bluetooth-Specification

**iv. Ground 2C(a): Claims 19 and 20 are Obvious Over
Dua-Barnes-N95 in view of Kao and Bluetooth-
Specification**

[19] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in frequency bandwidth.

225. According to Bluetooth-specification, the operating bandwidth for Bluetooth is 1MHz. LG-1011, 198-200. As such, Dua-Barnes (alone or combined with N95) in view of Kao and Bluetooth-Specification render it obvious that a short-range transceiver 108 (*first radio communication circuit*) operating on 1MHz Bluetooth bandwidth uses a bandwidth different from the 200KHz bandwidth that network transceiver 105 (*second radio communication circuit*) using GSM would use. LG-1017, ¶¶28, 31; *see also supra* [19] under GROUND 2 for the table summarizing the corresponding bandwidths.

[20] The method of claim 18, wherein the first radio communication circuit and the second radio communication circuit are different from each other in modulation/demodulation method

226. Dua-Barnes (alone or combined with N95) in view of Kao and Bluetooth-Specification render it obvious that a short-range transceiver 108 (*first radio communication circuit*) using Bluetooth would use a modulation scheme (GFSK/ $\frac{\pi}{4}$ DQPSK/8DPSK) different from the MSK modulation scheme that a network transceiver 105 (*second radio communication circuit*) connecting to a

GSM cellular network would use. LG-1011, 198-200; LG-1017, ¶31; *See also supra* [19] under GROUND 2 for the table summarizing the corresponding modulation schemes.

ADDITIONAL REMARKS

I currently hold the opinions set 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.

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

Dated: January 20, 2025

By: 

APPENDIX A

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Aug. 2001 – Aug. 2006	Assistant Professor, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Mobile and Portable Radio Research Group.
Aug. 2001 – Present	Independent Consultant, self-employed.
Aug. 1996 – Aug. 2001	Member Technical Staff, Bell Laboratories, Lucent Technologies, promoted to Distinguished Member of Technical Staff in September 2000.
Sep. 1993 – Jun. 1996	Graduate Research Assistant, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Mobile and Portable Radio Research Group.
May 1994 – Aug. 1994	Senior Engineer, Stanford Telecommunications, Advanced Programs.
Sep. 1991 – Aug. 1993	Graduate Research Assistant, The University of Toledo, Department of Electrical Engineering and Computer Science, Communications Research Group.

Honors and Recognitions

- Fellow of the IEEE (So named “for contributions to wideband signal processing in communications and geolocation”)
- 2023 MILCOM Lifetime Award for Technical Achievement
 - For Outstanding, Sustained Technical Contributions to Military Communications
- NSC Vanu Bose Best Paper Award *IEEE Military Communications Conference (MILCOM)* 2023.
- 2023 Fred W. Ellersick Award for the Best Paper in the Unclassified Technical Program, *IEEE Military Communications Conference (MILCOM)*, 2023
- NSC Vanu Bose Best Paper Award *IEEE Military Communications Conference (MILCOM)* 2021.
- Dean’s Award for Teaching Excellence - April 2014.
- 2010 Fred W. Ellersick Award for the Best Paper in the Unclassified Technical Program, *IEEE Military Communications Conference (MILCOM)* 2010.
- SDR Forum Best Paper Award, 2007.
- Outstanding Paper Award, SDR Forum, 2008.
- Dean’s Award for Outstanding New Assistant Professor, College of Engineering, 2003.
- Dean’s List for Teaching Effectiveness (teaching evaluation greater than 3.6) 16 out of 18 semesters list was published.
- Nominated for Certificate of Teaching Excellence (CTE), College of Engineering, Spring 2004 and Spring 2005.
 - Served as a member of the College of Engineering CTE committee from 2006 through 2021.
- Bell Labs President’s Silver Award for outstanding research contributions.
- 1999 Best Paper Award for *Bell Labs Technical Journal*.

Patents

- S. D. Gordon, R.M. Vaghefi, and R.M. Buehrer, “Estimating the Location of a Wireless Terminal Based on Cooperative Measurements,” *US Patent No. 10,527,708*, January 7, 2020.
- S. D. Gordon, R.M. Vaghefi, and R.M. Buehrer, “Estimating the Location of a Wireless Terminal Based on Radio-Frequency Pattern Matching and Cooperative Measurements,” *US Patent No. 9,989,620 B1*, June 5, 2018.
- S. D. Gordon, R.M. Vaghefi, and R.M. Buehrer, “Estimating the Location of a Wireless Terminal Based on Radio-Frequency Pattern Matching and Cooperative Measurements,” *US Patent No. 9,596,571 B1*, March 14, 2017.
- R.M. Buehrer, R.A. Soni, and J.A. Tsai, “Methods and Apparatus for Downlink Diversity in CDMA Using Walsh Codes,” *U.S. Patent No. 7,400,614 B2*, July 15, 2008.
- R. D. Benning, R. M. Buehrer, Mark H Kramlm, and P. A. Polakos, “Space-Time Spreading and Phase Sweep Transmit Diversity”, *US Patent No. 7,042,955 B2*, May 9, 2006.
- R.D. Benning, R.M. Buehrer, and R.A. Soni, “Biased Phase Sweep Transmit Diversity”, *US Patent No. 7,035,599 B2*, April 25, 2006.

- R. D. Benning, R. M. Buehrer, P. A. Polakos, and R. A. Soni, “Split Shift Phase Sweep Transmit Diversity, ” *US Patent No. 6,980,778 B2*, December 27, 2005.
- R.D. Benning, R.M. Buehrer, and R.A. Soni, “ Symmetric Sweep Phase Sweep Transmit Diversity”, *US Patent No. 6,920,314*, July 19, 2005.
- R.M. Buehrer, S.P. Nicoloso, R.A. Soni, and D. Uptegrove, “Cellular Communications System And Related Methods”, *US Patent No. 6,801,791*, October 5, 2004.
- R.M. Buehrer, S.-C. Liu, S.P. Nicoloso, and D. Uptegrove, “Method of channel estimation and compensation based thereon,” *U.S. Patent No. 6,542,560*, April 1, 2003.
- R.M. Buehrer and S.-C. Liu, “Code division multiple access system and method of operation with improved signal acquisition and processing,” *U.S. Patent No. 6,549,565*, April 15, 2003.
- R.D. Benning, R.M. Buehrer, and R.A. Soni, “Apparatus and method of enhancing transmit diversity,” *U.S. Patent No. 6,594,226*, July 15, 2003.
- R.M. Buehrer, S.-C. Liu, S.P. Nicoloso, and D. Uptegrove, “Iterative channel estimation and compensation based thereon,” *U.S. Patent No. 6,614,857*, September 2, 2003.
- R.M. Buehrer and R.A. Soni, “Methods And Apparatus For Downlink Diversity In CDMA Using Walsh Codes”, *U.S. Patent No. 6,515,978*, February 4, 2003.
- R.M. Buehrer, S. Gollamudi, and S.P. Nicoloso, “Multistage interference cancellation for CDMA applications using M-ary orthogonal modulation,” *US Patent No. 6,363,103*, March 26, 2002.
- S.A. Allpress, R.M. Buehrer, and R.A. Soni, “Receiver Architecture Employing Space Time Spreading and Orthogonal Transmit Diversity Techniques,” *US Patent No. 6,317,410 B1*, November 13, 2001.
- S.A. Allpress, R.M. Buehrer, Quinn Li, Ramesh Nallepilli, and R.A. Soni, “Transmitter Architecture Employing Space Time Spreading and Orthogonal Transmit Diversity Techniques,” *US Patent No. 6,392,988*, May 21, 2001.
- R.M. Buehrer, M.D. Hahm, S.C. Liu, and S.P. Nicoloso, “Base Station System Including Parallel Interference Cancellation Processor,” *US Patent No. 6,157,847*, December 5, 2000.

Teaching

Undergraduate Courses

- Engineering Exploration (ECE 1024)
- Electric Circuits (ECE 2004)
- Signals and Systems (ECE 2704, ECE 2714)
- Introduction to Communications (ECE 3614)
- Digital Communications (ECE 4634)
- Analog and Digital Communication Laboratory (ECE 4664)– *developed this course with \$70k grant from the State of Virginia.*

Graduate Courses

- Spread Spectrum Communications (ECE 5660)– *developed this course for the ECE department. It is has been a permanent offering since 2003.*
- Advanced Digital Communications (ECE 5654)
- Multi-Channel Communications (Course covers the fundamentals of OFDM and MIMO techniques the underlying technologies for 4G cellular communications) – *Developed this course for the ECE dept. It is has been a permanent offering since 2008.*
- Information Theory (ECE 5634)
- Machine Learning for Communication Systems (ECE 5984)

Teaching Evaluations (Fall 2001 through Spring 2011)

- Average student evaluation – 3.8/4.0 (17 courses, 450 students)
- Dean’s List (student evaluation > 3.6) in 16 of 18 semesters of teaching

Teaching Evaluations (Fall 2011 through Spring 2023)

- Average student evaluation – 5.5/6.0 (25 courses, > 700 students)

Short Courses Given

- Position Location
- Position Location using Ultra-Wideband Signals
- Radio Resource Management in CDMA Systems
- WiFi – An introduction to WLANs
- OFDM – Multicarrier transmission for high data rate systems; Application to 4G (LTE) cellular and Wi-Fi
- Ultra Wideband Communications
- Multi-Input Multi-Output (MIMO) Communication Systems; Application to 4G (LTE/LTE-Advanced) cellular and Wi-Fi

Advising

Current

- Don-Roberts Emenonye, ” Machine Learning Approaches to Remote Rehabilitation,” Ph.D. candidate, expected graduation December 2023.
- Sam Shebert, ”Automatically Classifying Modern Communication Waveforms,” Ph.D. candidate, expected graduation May 2024.
- Megan Moore, “Geolocation via LEO Networks,” Ph.D. candidate, expected graduation May 2025.

- Haozhou Hu, “Geolocation via Landmarks,” Ph.D. candidate, expected graduation May 2025.
- Gaurav Duggal, “Combined Radar and Communications Signals for Geolocation,” Ph.D. candidate, expected graduation May 2025.
- Harish Dureppagari, “Emergency Localization using UAVs and Collaborative Localization,” Ph.D. candidate, expected graduation May 2026.
- Kumar Sai Bondada, “Synchronization for Distributed MIMO,” Ph.D. candidate, expected graduation May 2026.
- Xinrui Li, “Interference Mitigation in Radio Astronomy,” Ph.D. candidate, expected graduation May 2026.
- Tom Anders, “Resource Allocation in Multi-static and Mono-static Radar Networks,” M.S. candidate, expected graduation December 2024.
- Olivia Leonard, “Resource Allocation in Cognitive Radar Networks,” M.S. candidate, expected graduation December 2025.
- Joe Esser, “Mode Control in Cognitive Radar Networks,” M.S. candidate, expected graduation May 2026.

Former

1. William H. Howard, “Distributed Learning for Cognitive Radar Networks,” Ph.D. November 2023.
2. Charlie Thornton, “On the Value of Online Learning for Cognitive Radar Waveform Selection,” Ph.D., May 2023.
3. Jianyuan Yu, “Wireless Sensing and Fusion using Deep Neural Networks,” Ph.D., August 2022.
4. Yue Xu, “Deep Recurrent Q Networks for Dynamic Spectrum Access in Dynamic Heterogeneous Environments with Partial Observations,” Ph.D., August 2022.
5. Chris O’Lone, “Statistical Analysis of Geolocation Fundamentals Using Stochastic Geometry,” Ph.D. December 2020.
6. Jeff Poston, “ILoViT: Indoor Localization via Vibration Tracking,” Ph.D. March 2018.
7. Mahi Abdelbar, “Applications of Sensor Fusion in Classification, Localization and Mapping,” Ph.D. February 2018.
8. Mico Woolward, “SUPPLEMENTING LOCALIZATION ALGORITHMS FOR INDOOR FOOTSTEPS,” Ph.D., July 2017.
9. Daniel Jakubisin, “Advances in Iterative Probabilistic Processing for Communication Receivers,” Ph.D., April, 2016, *currently employed by The Hume Center*.
10. Jeannette Nounagnon “Using Kullback-Leibler Divergence to Analyze the Performance of Collaborative Positioning,” Ph.D., April, 2016, *currently employed by ComSat*.
11. SaiDhiraj Amuru, “Intelligent Approaches for Communication Denial,” Ph.D., September, 2015, *currently employed by Samsung*.
12. Javier Schloemann, “Fundamental Analyses of Collaborative and Noncollaborative Positioning,” Ph.D., August, 2015, *currently employed by Northrup-Grumman*.
13. Reza Vaghefi, “Cooperative Positioning in Wireless Sensor Networks Using Semidefinite Programming,” Ph.D., December 2014, *currently employed by Blue Danube Labs*.

14. Jeong-heon Lee, "Physical Layer Security for Wireless Position Location in the Presence of Location Spoofing," Ph.D., March 2011, *currently employed by Samsung*.
15. Haris I. Volos, "Cognitive Radio Engine Design For Link Adaptation," Ph.D., September 2010, *currently employed by the University of Arizona*.
16. Tao Jia, "Collaborative Position Location for Wireless Networks in Harsh Environments," Ph.D., March 2010, *currently employed by Qualcomm, Inc.*
17. Heba Shaban, "A Novel Highly Accurate Wireless Wearable Human Locomotion," Ph.D., April 2010, *currently employed by Arab Academy of Science and Technology*.
18. Haesoo Kim, "Cooperative Communications," Ph.D., August 2008, *currently employed by LG Electronics*.
19. Rekha Menon, - "Interference Avoidance based Underlay Techniques for Dynamic Spectrum Sharing," Ph.D., April 2007, *currently employed by Tyco Electronics*.
20. Swaroop Ventkatesh, "The Design and Modeling of Ultra-Wideband Position-Location Networks," Ph.D., February 2007, *currently employed by Marvel Semiconductor*.
21. Jihad Ibrahim, "Algorithms and Architectures for UWB Receiver Design," Ph.D. January 2007, *currently employed by MathWorks*.
22. Chris Anderson, "A Software Defined Ultra Wideband Transceiver Testbed for Communications, Ranging, or Imaging," Ph.D., September 2006, *currently an Associate Professor at the US Naval Academy*.
23. Samir Al-Ghadhban - "Multi-layered Space Frequency Time Codes," Ph.D. October, 2005, *currently an associate professor at King Fahd University*.
24. Jing Jiang – "Increasing the Capacity of Wireless Data Systems - A Cross Layer Perspective," Ph.D., July 2004, *currently employed by Texas Instruments*.
25. Jiann-An Tsai – "Overloaded Array Processing Using Interference Cancellation," Ph.D., May 2002. *Currently employed by Samsung*.
26. Zachary Schutz, "Use of Reinforcement Learning for Interference Avoidance or Efficient Jamming in Wireless Communications," M.S., May 2024.
27. Sebastian Rodriguez, "Value of Machine Learning and Cognition on Target Tracking," M.S., June 2022.
28. C. Tanner Fredieu, "Spectrum Awareness: Deep Learning and Isolation Forest Approaches for Open-set Identification of Signals," M.S. May 2022.
29. Dhwan Wanjara, "A Python Software Library to Improve the Accessibility of the Apple Watch as a Research Tool," M.S. May 2022.
30. Daniel Tait, "Electromagnetic Vector-Sensor Direction-of-Arrival Estimation in the Presence of Interference," M.S. August 2020.
31. Don-Roberts Emenonye, "Application of Machine Learning to Multi-Antenna Transmission and Machine Type Resource Allocation," M.S. July 2020.
32. Charlie Thornton, "Learning Schemes for Adaptive Spectrum Sharing Radar," M.S. May 2020.
33. Mark Kozy, "Creation of a Cognitive Radar with Machine Learning: Simulation and Implementation," M.S., May 2019.
34. Bryse Flowers, "Adversarial RFML: Evading Deep Learning Enabled Signal Classification," M.S., June 2019.
35. Parker White, "Constrained Clustering for Frequency Hopping Spread Spectrum Signal Separation," M.S., August 2019.

36. Ersin Selvi, "Cognitive Radar Applied To Target Tracking Using Markov Decision Processes," M.S. December 2017, *currently employed by Raytheon.*
37. Ali Gaber Mohamed, "Navigating via Discrete Astronomical Radio Sources: Geolocation Using Fringe Rates," M.S. April 2017, *currently employed by Alexandria University.*
38. Eric Sollenberger, "Iterative Leakage-Based Precoding for Multiuser-MIMO Systems," M.S., May, 2016, *currently employed by Qualcomm, Inc..*
39. Kevin McDermott, "On the Improvement of Positioning in LTE with Collaboration and Pressure Sensors," M.S., May, 2015, *currently employed by Northrup Grumman*
40. Tori Jewell, "Use of GIS in Radio Frequency and Positioning Applications," M.S. June 2014.
41. Jacob Overfield, "The Impact of MIMO on Signal Localization," MS, May 2013, *currently employed by n-ask, inc.*
42. Zachary Biskaduros, "Collaborative GPS," MS, June 2013, *currently employed by n-ask, inc.*
43. Hunter DeJarnette, "Measuring Noise in the VHF Band and Its Effect On Low SNR Signal Detection," MS Thesis, September 26, 2012, *currently employed by Johns Hopkins Applied Physics Lab.*
44. Benton Thompson, "Characterization and Improvement of the Collaborative and Non-Collaborative Position Location Problems," MS, August 2011, *currently employed by G3, Inc.*
45. Corey Cooke, "Attenuation Field Estimation using Radio Tomography," MS, August 2011, *currently a Ph.D. student at Georgia Tech.*
46. Harpreet Dhillon, "The Optimal Sum-Rate of Multi-Band MIMO Interference Channel," MS, July 2010, *currently an Assistant Professor at Virginia Tech.*
47. Justin Kelly, "The Value of Collaboration in Dynamic Spectrum Access," MS, July 2009, *currently employed by the Department of Energy.*
48. Matthew Roney, "Dual-Channel Direction Finding in Multipath Channels," M.S. candidate, *currently employed by DRS Signal Solutions.*
49. Jesse Reed, "Approaches to Multiple-source Localization and Signal Classification," MS, May, 2009, *currently employed by Arinc, Inc.*
50. Chang Li, "Non-contact Estimation of Respiration and Heartbeat Rate using Ultra Wideband," MS, August 20, 2008, *currently employed by Qualcomm, Inc.*
51. Arjun Bhupathi Raju, "Characterization of Uplink Transmit Power and Talk-Time in WCDMA Networks", MS, July 15, 2008, *currently employed by Qualcomm, Inc.*
52. Rajaraman Parameswaran – "Effects of user and spatial diversity on high data rate wireless systems," M.S., August 2005, *currently employed by Qualcomm Inc.*
53. Nathan Harter, "Single Channel Direction Finding in Multipath Channels," M.S., April 2007, *currently employed by IO-Max.*
54. John Keaveny – "The Implementation of Single-Channel Direction Finding," M.S., February 2005. *Currently employed by Boeing.*
55. Brian Donlan, "Ultra-wideband Narrowband Interference Cancellation and Channel Modeling for Communications," M.S., January 2005, *currently employed by IOMAX USA.*
56. Vivek Baradwaj, "Ultra-Wideband for Communications: Spatial Characteristics and Interference Suppression," M.S., April 2005. *Currently employed by Qualcomm, Inc.*

57. Liu Yang, “On the Applicability of the Tap-delay Line Model to UWB Channel Modeling,” M.S., August 2004, *currently employed by Microsoft.*
58. Dan Hibbard, “The Impact of Bandwidth on Indoor Communication System Performance,” M.S., May 2004. *Currently employed by Raytheon.*
59. Nishant Kumar – “MAC and Physical Layer Design for Ultra-Wideband Communications,” M.S., May 2004. *Currently employed by Staccato Communicaitons.*
60. Samir Ginde – “A Game-theoretic Analysis of Link Adaptation in Cellular Radio Networks,” M.S., May 2003. *Currently employed by Qualcomm, Inc.*
61. Rahul Mahajan – “Cross Layer Optimization: System Design and Simulation Methodologies,” M.S., December, 2003. *Currently employed by Qualcomm, Inc.*
62. Aaron Orndorf, “Transceiver Design for Ultra Wideband Communications,” M.S., completed May 2004.
63. David McKinsty – “Channel Models and Receivers for Ultra Wideband Communications,” M.S., May 2003. *Currently employed by Johns Hopkins Applied Physics Lab.*
64. Venkatasubramanian Ramasamy – “MC-CDMA/OFDM and Adaptive Antennas,” M.S., June 2002. *Currently employed by Apple.*
65. Ray Chan – “Link Adaptation for Public Safety Wireless Information Networks,” M.S., June 2003. *Currently employed by Northrup Grummond Corp.*
66. Payal Jain – “Software Radio Implementation of Adjustable High Data Rate Receivers,” M.S., November 2002. *Currently employed by Digital Receiver Technology, Germantown, MD.*

Funded Research

1. Title: “Spectrum Situational Awareness via Cognitive Radar Networks,”
Sponsor: Army Research Lab (via Baylor University),
Funding: \$575,318
Period of Performance: , May, 2024 - May, 2025
Percent: 35%.
2. Title: “Mobile Distributed MIMO: Learning Meets Spreading in Networking,”
Sponsor: Advanced Technology International,
Funding: \$8,741,427
Period of Performance: , September, 2023 - July, 2026
Percent: 10%.
3. Title: “Fundamentals of Geotagging Images and Videos Using Non-Unique Landmarks,”
Sponsor: Commonwealth Cybersecurity Initiative,
Funding: \$37,500
Period of Performance: , July 1, 2024 - July 1, 2025
Percent: 50%.
4. Title: “Design and Control of Multi-modal Sensors and Sensor Networks,”
Sponsor: Army Research Lab,
Funding: \$200,000 (\$910,962 max)
Period of Performance: , September 1, 2023 - August 31, 2024
Percent: 100%.

5. Title: “Multi-Target Detection and Tracking with Multi-Mode Radar Networks,”
Sponsor: Lockheed Martin,
Funding: \$150,000,
Period of Performance: August 1, 2023 - July 31, 2024
Percent: 50
6. Title: “Development of Machine Learning Methodologies for Radar Signal Classification,”
Sponsor: Alion,
Funding: \$118,000,
Period of Performance: January 26, 2023 – December 31, 2024
Percent: 100
7. Title: “Prototyping 5G-enabled Indoor Geolocation System for Fire Fighters using UAVs,”
Sponsor: National Institutes of Standards and Technology (through George Mason University),
Funding: \$849,994,
Period of Performance: June 1, 2022 – May 31, 2025
Percent: 34
8. Title: “SWIFT: Electronically-Reconfigurable Surfaces for Improved Coexistence Between Radio Astronomy and Satellite Communications Systems,”
Sponsor: National Science Foundation,
Funding: \$748,463,
Period of Performance: September 1, 2021 - August 31, 2024.
Percent: 50%.
9. Title: “Collaborative Research: CNS Core: Medium: Localization in Millimeter Wave Cellular Networks: Fundamentals, Algorithms, and Measurement-inspired Simulator,”
Sponsor: National Science Foundation,
Funding: \$635,000,
Period of Performance: October 2021 – September 2025.
Percent: 50%.
10. Title: “SWIFT: SMALL: Interference Canceling for Improved Coexistence for Passive and Active Radio Systems,”
Sponsor: National Science Foundation,
Funding: \$499,999,
Period of Performance: January 2021– January 2024.
Percent: 50%.
11. Title: “SCH:INT: Collaborative Research: Semi-Automated Rehabilitation in the Home,”
Sponsor: National Science Foundation,
Funding: \$1.1M
Period of Performance: August 2020 – July 2024,
Percent: 10%
12. Title: “Vector Sensor Processing in the Presence of Multipath”
Sponsor: Applied Signals Intelligence
Funding: \$170,000
Period of Performance: April 2020 - April 2021.
Percent: 90%
13. Title: “Machine Learning Approaches to Optimize Army Radar, Communication and EW Systems”
Sponsor: Army Research Lab
Funding: \$975,000
Period of Performance: May 11, 2020 - May 10, 2024.
Percent: 100%

14. Title: “Vector Sensor Processing in the Presence of Interference”
Sponsor: Applied Signals Intelligence
Funding: \$232,193
Period of Performance: December 20, 2018 - April 30, 2019.
Percent: 60%
15. Title: “Digital Beamforming and Interference Mitigation for MIMO Systems ”
Sponsor: GIRD Systems
Funding: \$1,575,398
Period of Performance: October 17, 2018 - October 16, 2021.
Percent: 50%
16. Title: “Cognitive Radar for C-SCoRE: Enhancing Radar Functionality though Interference Analysis and Avoid-
ance,”
Sponsor: Georgia Tech Research Institute (AFRL)
Funding: \$285,000
Period of Performance: December 15, 2018 – May 30, 2022
Percent: 100%
17. Title: “Collaborative Learning for Harmonious Coexistence of Heterogeneous Wireless Networks”
Sponsor: Defense Advanced Research Projects Agency
Funding: \$1,999,994
Period of Performance: January 1, 2017 - December 30, 2019.
Percent: 25%
18. Title: “MU-MIMO Channel Characterization”
Sponsor: GIRD Systems
Funding: \$117,712
Period of Performance: April 1, 2017 - March 31, 2019.
Percent: 100%
19. Title: “Cognitive Radio Approaches to Optimize Army Radar Systems”
Sponsor: Army Research Lab
Funding: \$250,000
Period of Performance: January 1, 2018 - December 30, 2020.
Percent: 100%
20. Title: “Cognitive Radio Approaches to Optimize Army Radar and Communication Systems”
Sponsor: Army Research Lab
Funding: \$190,282
Period of Performance: January 1, 2017 - December 30, 2017.
Percent: 50%
21. Title: “Hyper-wideband Communications”
Sponsor: Defense Advanced Research Projects Agency
Funding: \$182,451
Period of Performance: May 1, 2015 - April 30, 2016.
Percent: 50%
22. Title: “IUSE: Gamification of Wireless Communication Testbeds for Authentic STEM Learning”
Sponsor: National Science Foundation
Funding: \$626,665
Period of Performance: Sept. 1, 2014 - Aug. 31, 2017.
Percent: 20%
23. Title: “Advanced Cognitive Radio Design using SDRs”
Sponsor: Lockheed Martin Advanced Technologies

- Funding: \$494,600
Period of Performance: April 1, 2014 – Sept. 30, 2015
Percent: 100%
24. Title: “SDR Technology Development Support”
Sponsor: DoD
Funding: \$375,000
Period of Performance: 5/1/14 – 4/30/14
P.I.: J.H. Reed
Percent: 30%
25. Title: “Improving Cellular Positioning through Collaboration”
Sponsor: Polaris Wireless
Funding: \$82,813
Period of Performance: 11/01/2013 - 10/31/2014
Percent: 100%
26. Title: “Advanced Wireless Systems and Technologies”
Sponsor: DoD
Funding: \$3,883,320
Period of Performance: 07/01/2012 - 06/30/2014
P.I. R.W. McGwier
Percent: 10%
27. Title: “Cognitive Radio Development”
Sponsor: Lockheed Martin – Advanced Technologies Lab
Funding: \$325,000
Period of Performance: 7/1/2012 – 12/31/2013
P.I. R.M. Buehrer
Percent: 50%
28. Title: “Next Generation Secure, Scalable Communication Network for the Smart Grid”
Sponsor: Oak Ridge National Labs
Funding: \$626,671
Period of Performance: 1/1/2011-10/31/2012
PI – R.M. Buehrer
Co-PI: J.H. Reed
Percent: 50%
29. Title: “Software Defined Radio Waveform and Device Development And Component Deployment Using Ossie”
Sponsor – DoD (Maryland Procurement Office)
PI – RM Buehrer
Period of Performance: Aug. 1, 2010 – July 31, 2013
Funding: \$299,227
Percent: 100%
30. Title: “SDR Technology Development Support”
Sponsor – DoD (Maryland Procurement Office)
PI – R.M. Buehrer and J.H. Reed
Funding: \$638,653
Period of Performance: 9/30/2010 – 4/30/2014
Percent: 75%
31. Title: “Signal Processing Research”
Sponsor: Aerospace Corp.
PI: T.C. Clancy
Co-PI: R.M. Buehrer

- Period of Performance: 1/1/2011 – 10/31/2011
Funding: \$130k
Percent: 50%
32. Title: “IHCS: Proactive Cross-Layer Adversary Localization for Hostile or Harsh Wireless Environments”
Sponsor: National Science Foundation
Funding: \$494,788
Period of Performance: 5/1/08 – 4/30/11
PI: Y. Yang
Co-PI’s: R.M. Buehrer and J.M. Park
Percent: 33%
33. Title: “A Fundamental Analysis of Spectrum Sharing”
Sponsor: Qualcomm, Inc.
Funding: \$120,000
Period of Performance: 5/1/08 – 4/30/10
PI: Buehrer
Co-PI’s: Y. Yang
Percent: 85%
34. Title: “Reasoning and Learning in Adaptive Wireless Networks”
Sponsor: BBN/DARPA
Funding: \$605,000
Period of Performance: 10/1/07 – 3/31/10
PI: L. DaSilva
Co-PI’s: R.M. Buehrer, C. Bostian, A. MacKenzie, and J.H. Reed
Percent: 25%
35. Title: DRS Graduate Fellowship
Sponsor: DRS Signal Solutions
Funding: \$76,000
Period of Performance: 9/01/07 – 8/30/09
PI: R.M. Buehrer
Percent: 100%
36. Title: U-PoLo Nets – Position Location in Harsh Environments
Sponsor: National Science Foundation
Funding: \$175k
Period of Performance: 8/1/05 – 7/30/08
PI: R.M. Buehrer
Percent: 100%
37. Title: NeTS ProWiN: An Open Systems Approach for Rapid Prototyping Waveforms for Software Defined Radio
Sponsor: National Science Foundation
Funding: \$1M
Period of Performance: 8/1/05 – 7/30/09
PI: J.H. Reed (lead), R.M. Buehrer, and W.H. Tranter
Percent: 33%
38. Title: Node and Network Benefits of Improved RF Characteristics in CDMA Cellular Networks
Sponsor: ParkerVision
Funding: \$131,474
Period of Performance: 11/1/07 – 10/31/08
PI: R. M. Buehrer
Percent: 100%

39. Title: UWB Propagation in Office Environments
Sponsor: Freescale Semiconductor
Funding: \$35,000
Period of Performance: 5/1/05 – 4/30/06
PI: R. M. Buehrer
Percent: 100%
40. Title: Networking Issues for Peer-to-Peer VoIP Link for Radio Interoperability, Fire Management and Security
Sponsor: Catalyst Communications
Funding: \$67,500
Period of Performance: 1/1/05 – 5/15/05
PI: S.M. Midkiff (lead) and R.M. Buehrer
Percent: 33%
41. Title: AWINN: Advanced Wireless Networking for the Navy
Sponsor: ONR
Funding: \$3M
Period of Performance: 12/20/04 – 6/19/06
PI: Warren Stutzman
Co-PI's: J.H. Reed, Scott Midkiff, R. M. Buehrer, W.H. Tranter, Peter Athanas, Tom Hou, Binoy Ravindran, Rick Habayeb
Percent: 10%
42. Title: Ultra Wideband Communications Systems
Sponsor: ASPIRES
Funding: \$118,360
Period of Performance: 7/1/03 – 6/30/04
PI: R. M. Buehrer
Percent: 100%
43. Title: UWB Communications
Sponsor: Motorola
Period of Performance: 12/15/03 – 12/14/04
Funding: \$35,000
PI: Buehrer
Percentage: 100%
44. Title: Simulation of Ultra Wideband Communications
Sponsor: ITRI
Funding: \$10,000
Period of Performance: 9/1/03 – 12/31/03
PI: R.M. Buehrer
Percent: 100%
45. Title: Receiver Design for Ultra Wideband Communications
Sponsor: ITRI
Funding: \$15,000
Period of Performance: 9/1/03 – 12/31/03
PI: R.M. Buehrer
Percent: 100%
46. Title: Indoor Propagation
Sponsor: Qualcomm, Inc.
Funding: \$14,000
Period of Performance: 12/1/03 – 5/15/04
PI: R.M. Buehrer
Percent: 100%

47. Title: Single Channel Direction Finding
 Sponsor: DRS Technologies
 Funding: \$91,000
 Period of Performance: 10/18/02 – 10/17/05
 PI: R. M. Buehrer
 Percent: 100%

48. Title: Flexible High Data Rate Transmission for Wireless Data Applications
 Sponsor: BAE Systems
 Funding: \$29,000
 Period of Performance: 10/18/01 – 10/17/02
 PI: R. M. Buehrer
 Percent: 100%

49. Title: UWB Propagation Measurements, Modeling, and Communication System Enhancements
 Sponsor: Defense Advanced Research Projects Agency
 Funding: \$688,620
 Period of Performance: 5/13/02-5/12/03
 PI: R.M. Buehrer
 Co-PI: A.S. Safaai-Jazi, W. Davis, D. Sweeney
 Percentage: 35%

50. Title: Modeling and Simulation for the FCS Development Environment
 Sponsor: Boeing
 Funding: \$127,022
 Period of Performance: 5/1/02 - 4/1/03
 PI: W. H. Tranter
 Co-PI: R. M. Buehrer, A. Annamalai
 Percentage: 33%

51. Title: The Benefits of Multiple Antennas at the Handset for Cellular CDMA
 Sponsor: e-Tenna Corporation
 Funding: \$15,000
 Period of Performance: 5/15/02 – 8/14/02
 PI: R. M. Buehrer
 Percent: 100%

52. Title: MPRG Affiliates Program
 Sponsor: Analog Devices, ARO, Cingular, DRS Technologies, General Motors, General Dynamics, Huawei Technologies, Hughes, Lucent Technologies, Motorola, Qualcomm, Raytheon, Samsung, SW Bell, Texas Instruments, et. al.
 Funding: \$2M
 Period of Performance: 8/25/01 – 5/15/11
 PI: J.H. Reed
 Co-PI's: R.M. Buehrer, W.H. Tranter, S.W. Ellingson, others
 Percent: 20%

Book Publications

1. S. Zekavat and R.M. Buehrer, editors, Position Location - Theory, Practice and Advances, Second Ed., Wiley-IEEE, 2019.
2. S. Zekavat and R.M. Buehrer, editors, Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.

3. J.H. Lee and R.M. Buehrer, "Security Issues in Position Location," Chapter 3 in Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.
4. R. M. Buehrer and S. Venkatesh, "Fundamentals of Time-of-Arrival-based Position Location," Chapter 6 in Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.
5. J.H. Lee and R.M. Buehrer, "Fundamentals of Received Signal Strength Based Position Location," Chapter 11 in Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.
6. T. Jia and R.M. Buehrer, "Collaborative Position Location," Chapter 23 in Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.
7. R.M. Buehrer, An Introduction to Code Division Multiple Access (CDMA), Morgan-Claypool Publishers, 2007.
8. R.A. Soni and R.M. Buehrer, "Multiple Antenna Techniques in 3G Wireless Systems," Chapter 25 in Space-Time Wireless Systems: From Array Processing to MIMO Communications, H. Bolecskei, D. Gesbert, C. Papadias, and A.J. vander Veen, editors, Cambridge University Press, 2005.
9. R.M. Buehrer, "Channel Modeling," Chapter 3 in An Introduction to Ultra Wideband Communication Systems, Jeff Reed, editor, pp. 73-158, Prentice-Hall, 2005.
10. A.F. Molisch, J. Kunisch, R. Qiu, D. Cassioli, M. Buehrer, M. Pendergrass, I.Z. Kvac, G.F. Pedersen, P.C.F. Eggers, S. Roy and I. Ramachandran, "UWB Propagation Channels," Chapter 2 in UWB Communication Systems – A Comprehensive Overview, M.-G. Di Benedetto, T. Kaiser, A.F. Molisch, I. Oppermann, C. Politano, and D. Porcino, editors, pp.21-142, Hindawi Publishing Company, 2006.
11. M. Dohler, J. Liu, S. Venkatesh, R.M. Buehrer and B. Allen, "Large- and Medium-Scale Propagation Modelling," Chapter 14 in Ultra-wideband Antennas and Propagation for Communications, Radar and Imaging, B. Allen, et. al., editors, pp. 283-308, John Wiley and Sons, 2006.
12. S. Venkatesh, R.M. Buehrer, J. Liu, and M. Dohler, "Small-Scale Ultra-wideband Propagation Modelling," Chapter 15 in Ultra-wideband Antennas and Propagation for Communications, Radar and Imaging, B. Allen, et. al., editors, pp. 309-330, John Wiley and Sons, 2006.
13. R. Muhamed, R.M. Buehrer, A. Doradla, and T.S. Rappaport, "Mobile and Portable Radio Communications," Chapter 139 in The Engineering Handbook, Second Ed., R.C. Dorf, Editor, pp. 139-1 - 139-19, CRC Press, 2004.
14. T.S. Rappaport, R. Muhamed, M. Buehrer, and A. Doradla, "Mobile and Cellular Radio Systems," The Engineering Handbook, R. C. Dorf Editor, CRC Press, 1996.
15. R.M. Buehrer and B.D. Woerner, "Spread Spectrum for Wireless Communications," Wireless Personal Communications: Research Developments, B.D. Woerner, T.S. Rappaport, and J.H. Reed editors, Kluwer Academic Press, 1995.
16. H. Shaban, M. A. El-Nasr, and R. M. Buehrer, "A Full-Body Wireless Wearable UWB-Based Human Motion Capture and Gait Analysis System," Chapter 20 in E-Healthcare Systems and Wireless Communications: Current and Future Challenges, pp. 434-459, Prof. Mohamed K. Watfa, Editor.

Journal Publications

1. W. Howard, A. F. Martone, and R.M. Buehrer, "Timely Target Tracking: Distributed Updating in Cognitive Radar Networks," *IEEE Transactions on Radar Systems*, vol. 2, pp. 318-332, DOI: 10.1109/TRS.2024.3373535, February 2024.
2. J. Budhu, S. Ellingson, S. Hum, and R.M. Buehrer, "Design of Rim-Located Reconfigurable Reflectarrays for Interference Mitigation in Reflector Antennas," *IEEE Transactions on Antennas and Propagation*, vol. 72, no. 4, pp. 3736-3741, April 2024. DOI:10.1109/TAP.2024.3352250.

3. J. Yu, W. Howard, Y. Xu, and R.M. Buehrer, "Model Order Estimation in the Presence of multipath Interference using Residual Convolutional Neural Networks," *IEEE Transactions on Wireless Communications*, vol. 23, no. 7, pp. 7349-7361, July 2024, DOI: 10.1109/TWC.2023.3339803.
4. D.-R. Emenonye, H. S. Dhillon, and R.M. Buehrer, "On the Limits of Single Anchor Localization: Near-Field vs. Far-Field," *IEEE Wireless Communications Letters*, vol. 13, no. 2, pp. 540-544, Feb. 2024, DOI: 10.1109/LWC.2023.3335611.
5. C.E. Thornton and R.M. Buehrer, "On the Value of Online Learning for Radar Waveform Selection," *IEEE Transactions on Radar Systems*, vol. 1, pp. 505-519, DOI: 10.1109/TRS.2023.3313624.
6. W.H. Howard and R.M. Buehrer, "Hybrid Cognition for Target Tracking in Cognitive Radar Networks," *IEEE Transactions on Radar Systems*, vol. 1, pp. 118-131, DOI: 10.1109/TRS.2023.3282846.
7. C. E. Thornton, R. M. Buehrer, and A. F. Martone, "Online Bayesian Meta-Learning for Cognitive Tracking Radar," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 59, No. 5, pp. 6485-6500, Oct. 2023, doi: 10.1109/TAES.2023.3275552.
8. D.-R. Emenonye, H. S. Dhillon and R. Michael Buehrer, "RIS-Aided Localization under Position and Orientation Offsets in the Near and Far Field," *IEEE Transactions on Wireless Communications*, vol. 22, no. 12, pp. 9327-9345, doi: 10.1109/TWC.2023.3270029.
9. D. -R. Emenonye, H. S. Dhillon and R. M. Buehrer, "Fundamentals of RIS-Aided Localization in the Far-Field," *IEEE Transactions on Wireless Communications*, vol. 23, no. 4, pp. 3408-3424, April 2024. doi: 10.1109/TWC.2023.3307818.
10. D. -R. Emenonye, A. Sarker, A. T. Asbeck, H. S. Dhillon and R. M. Buehrer, "RIS-Aided Kinematic Analysis for Remote Rehabilitation," *IEEE Sensors Journal*, vol. 23, No. 19, 2023, doi: 10.1109/JSEN.2023.3308920.
11. S.W. Ellingson and R.M. Buehrer, "Coherent Time-Domain Canceling of Interference for Radio Astronomy," *Publications of the Astronomical Society of the Pacific*, 134, no. 1041 (2022): 114505, doi:10.1088/1538-3873/ac9b92
12. W.W. Howard, A.F. Martone, and R.M. Buehrer, "Distributed Online Learning for Coexistence in Cognitive Radar Networks," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 59, no. 2, pp. 1202-1261, April 2023, doi: 10.1109/TAES.2022.3198038.
13. J. Yu, P. Wang, T. Koike-Akino, Y. Wang, P. V. Orlik and R. M. Buehrer, "Multi-Band Wi-Fi Sensing with Matched Feature Granularity," *IEEE Internet of Things Journal*, vol. 9, no. 23, pp. 23810-23825, 2022, doi: 10.1109/JIOT.2022.3190826
14. M. O. Moore, R. M. Buehrer and W. C. Headley, "Decoupling RNN Training and Testing Observation Intervals for Spectrum Sensing Applications," *Sensors* 2022, 22(13), *Special Issue on Radio Frequency Machine Learning (RFML) Applications* 4706; doi: 10.3390/s22134706.
15. C.E. Thornton, R.M. Buehrer, H.S. Dhillon, and A.F. Martone, "Universal Learning Waveform Selection Strategies for Adaptive Target Tracking," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 58, no. 6, pp. 5798-5814, Dec. 2022. doi: 10.1109/TAES.2022.3181554
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19. L.J. Wong, W. H. Clark IV, B. Flowers, R. M. Buehrer, A. J. Michaels, and W. C. Headley, "An RFML Ecosystem: Considerations for the Application of Deep Learning to Spectrum Situational Awareness," *IEEE Open Journal of the Communications Society*, vol. 2, pp. 2243-2264, 2021, doi: 10.1109/OJCOMS.2021.3112939.
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22. S. R. Zekavat, R. M. Buehrer, G. D. Durgin, L. Lovisolo, Z. Wang, S.T. Goh, and A. Ghasem, "An Overview of Position Location: Past, Present, Future," *International Journal of Wireless Information Networks*, vol. 28, pp. 45-76, March 2021, Digital Object Identifier: 10.1007/s10776-021-00504-z.
23. C.E. Thornton, M. Kozy, A. F. Martone, K. Sherbondy, and R.M. Buehrer, "Deep Reinforcement Learning Control for Radar Detection and Tracking in Congested Spectral Environments," *IEEE Transactions on Cognitive Communications and Networking*, Vol. 6, No. 4, pp. 1335-1349, December 2020, Digital Object Identifier: 10.1109/TCCN.2020.3019605.
24. E. Selvi, R.M. Buehrer, A. Martone, and K. Sherbondy, "Reinforcement Learning For Adaptable Bandwidth Tracking Radars," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 56, No. 5, pp. 3904-3921, October 2020. Digital Object Identifier: 10.1109/TAES.2020.2987443.
25. Y. Xu, J. Yu, and R.M. Buehrer, "The Application of Deep Reinforcement Learning to Distributed Spectrum Access in Dynamic Heterogeneous Environments with Partial Observations," *IEEE Transactions on Wireless Communications*, vol. 19, no. 7, pp. 4494-4506, July 2020.
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28. B. Flowers, W.C.Headley, and R.M. Buehrer, "Evaluating Adversarial Evasion Attacks in the Context of Wireless Communications," *IEEE Transactions on Information Forensics and Security*, vol. 15, no. 1, pp. 1102-1113, January 2020.
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30. C.E. O'Lone, H.S. Dhillon, and R.M. Buehrer, "A Statistical Characterization of Localization Performance in Wireless Networks," *IEEE Transactions on Wireless Communications*, vol. 17, no. 9, pp. 5841-5856, Sept. 2018.
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Conference Publications/Presentations

1. S. Dhungel, G. Duggal, D. Ron, N. Tripathi, R. M. Buehrer, J. H. Reed, and V. K. Shah, "Experimental Validation of a 3GPP compliant 5G-based Positioning System," *18th ACM Workshop on Wireless Network Testbeds, Experimental Evaluation & Characterization (WINTECH'24)*, Washington, D.C., November 18, 2024.

2. X. Li, R.M. Buehrer and S.W. Ellingson, "An Improved Weight Selection Algorithm for Interference Mitigation in Paraboloidal Reflector Antennas With Reconfigurable Rim Scattering," accepted for presentation at the *2024 IEEE Military Communications Conference (MILCOM'24), Workshop on Spectrum: Pioneering the Future of Spectrum Sharing*, Washington, D.C., Oct. 28-Nov. 1, 2024.
3. W. J Hussain, G. Duggal, H.S. Dhillon and R. M. Buehrer, "The Role of Age in Adversarial Localization Scenarios," accepted for presentation at the *2024 IEEE Military Communications Conference (MILCOM'24)*, Washington, D.C., Oct. 28-Nov. 1, 2024.
4. Z. Schutz, D.J. Jakubisin, C.E. Thornton, and R.M. Buehrer, "Linear Jamming Bandits: Learning to Jam 5G-Based Coded Communications Systems," accepted for presentation at the *2024 IEEE Military Communications Conference (MILCOM'24)*, Washington, D.C., Oct. 28-Nov. 1, 2024.
5. D.-R. Emenonye, H.S. Dhillon, and R.M. Buehrer, "Joint 9-D Receiver Localization and Ephemeris Correction With LEO and 5G Base Stations," accepted for presentation at the *2024 IEEE Military Communications Conference (MILCOM'24)*, Washington, D.C., Oct. 28-Nov. 1, 2024.
6. D.-R. Emenonye, H.S. Dhillon, and R.M. Buehrer, "Is 9-D Localization Possible With Unsynchronized LEO Satellites?," accepted for presentation at the *2024 IEEE Military Communications Conference (MILCOM'24)*, Washington, D.C., Oct. 28-Nov. 1, 2024.
7. K. S. Bondada, D. J. Jakubisin, K. Said, R. M. Buehrer, and L. Liu "Wireless Mobile Distributed-MIMO for 6G," accepted for presentation at the *100th IEEE Vehicular Technology Conference*, Washington, D.C., Oct. 7-10, 2024.
8. D.-R. Emenonye, H.D. Dhillon, and R.M. Buehrer, "Minimal Configurations to Achieve 3D Positioning with Unsynchronized LEO Satellites," accepted for presentation at *100th IEEE Vehicular Technology Conference (VTC)*, Washington, D.C., October 7-10, 2024.
9. D.-R. Emenonye, H.D. Dhillon, and R.M. Buehrer, "Can Unsynchronized LEOs Provide 3D Orientation for a Ground Receiver?" accepted for presentation at *100th IEEE Vehicular Technology Conference (VTC)*, Washington, D.C., October 7-10, 2024.
10. R. Michael Buehrer, "Wireless Positioning: A History, the State of the Art and Current Research," **Key Note Presentation** at *2024 IEEE International Communication Conference (ICC 2024), 3rd Workshop on Synergies of Communication, Localization, and Sensing towards 6G*, Denver, CO, June 9-13, 2024.
11. M. Moore, C.W. Headley, and R.M. Buehrer, "Time-Diverse Doppler-Only PNT: Initial Solution," accepted for presentation at *The ION GNSS+ 2024 Conference*, September 16-20, 2024, Baltimore, Maryland.
12. G. Duggal, H. S. Dhillon and R.M. Buehrer, "3D Positioning using a New Diffraction Path Model," *2024 IEEE International Communication Conference (ICC 2024), 3rd Workshop on Synergies of Communication, Localization, and Sensing towards 6G*, Denver, CO, June 9-13, 2024.
13. M. Moore, W.C. Headley, and R.M. Buehrer, "Approaches to Minimizing Geometric Dilution of Precision in Doppler-based Positioning Using LEO Satellites," *2024 IEEE DySPAN Workshop on "Signal Reuse for Spectrum Efficiency*, May 13, 2024, Washington, DC, USA.
14. H. Dureppagari, H.S. Dhillon, and R.M. Buehrer, "UAV-Based 5G Localization for Emergency Response Using Signals of Opportunity," *2024 IEEE DySPAN Workshop on "Signal Reuse for Spectrum Efficiency"*, May 13, 2024, Washington, DC, USA.
15. Z. Schutz, C.E. Thornton, D.J. Jakubisin, and R.M. Buehrer, "Linear Jamming Bandits: Learning to Jam OFDM-Modulated Signals," *2024 IEEE International Communications Conference (ICC'24)*, 9–13 June 2024, Denver, CO, USA.
16. J. Budhu, S. V. Hum, S. W. Ellingson, and R. M. Buehrer, "Loading Rims of Radio Telescopes with Reconfigurable Reflectarrays for Adaptive Null-Steering," *2024 USNC-URSI National Radio Science Meeting (NRSM)*, Jan. 9 - 13, 2024, Boulder, CO.

17. S. W. Ellingson, R. M. Buehrer, T. Anders, and X. Li, "New Results on Mitigation of Satellite Interference by Coherent Time-Domain Canceling," *2024 USNC-URSI National Radio Science Meeting (NRSM)*, Jan. 9 - 13, 2024, Boulder, CO.
18. M.O. Moore, R. M. Buehrer, and W. C. Headley, "Time-Diverse Doppler-only LEO PNT," *2023 Military Communications Conference (MILCOM'23)*, Oct. 30 - Nov. 3, 2023, Boston, MA. Winner of **NSC Vanu Bose Best Paper Award**, and **Fred W. Ellersick Award for the Best Paper in the Unclassified Technical Program**.
19. H. Hu, H.S. Dhillon and R.M. Buehrer, "Landmark-based Localization using Pairwise Constraints: A Stochastic Geometry Perspective," *Proceedings of SpaSWiN 2023*.
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22. H. K. Dureppagari, D.-R. Emenonye, H. S. Dhillon, and R. M. Buehrer, "UAV-Aided Indoor Localization of Emergency Response Personnel," *IEEE/ION Position Location and Navigation Symposium*, April 24-27, 2023, Monterey, CA.
23. D.-R. Emenonye, A. Pradhan, H.S. Dhillon, and R.M. Buehrer, "OTFS Enabled RIS-Aided Localization: Fundamental Limits and Potential Drawbacks," *IEEE/ION Position Location and Navigation Symposium*, April 24-27, 2023, Monterey, CA.
24. S.V. Hum, S.W. Ellingson, and R.M. Buehrer, "Toward Electronically Reconfigurable Rims for Reflectors in Radio Astronomy," *URSI General Assembly and Scientific Symposium 2023*.
25. S.V. Hum, S.W. Ellingson, and R.M. Buehrer, "Reflectarray Concept for Interference Mitigation in Radio Astronomy," *2023 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting*, 23-28 July, 2023, Portland, OR.
26. W.H. Howard and R.M. Buehrer, "Timely Target Tracking in Cognitive Radar Networks," *2023 IEEE Radar Conference*, San Antonio, Texas, May 1-5, 2023.
27. C.E. Thornton and R.M. Buehrer, "When Is Cognitive Radar Beneficial?" *2023 IEEE Radar Conference*, San Antonio, Texas, May 1-5, 2023.
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29. G. Duggal, R.M. Buehrer, J. Reed, and N. Tripathi, "Line-of-Sight Probability for Outdoor-to-Indoor UAV-Assisted Emergency Networks," *IEEE 2023 IEEE International Conference on Communications (ICC'23)*, 28 May – 01 June 2023, Rome, Italy.
30. R.M. Buehrer and S.W. Ellingson, "Weight Selection for Pattern Control of Paraboloidal Reflector Antennas with Reconfigurable Rim Scattering," *Proceedings of the 2023 IEEE Aerospace Conference*, March 5-9, 2023, Big Sky, Montana.
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32. S. Shebert, M.G. Amin, B.H. Kirk, and R.M. Buehrer, "Multi-Signal Classification Using Deep Learning and Sparse Arrays," *2022 IEEE Military Communications Conference (MILCOM '22)*, Rockville, MD, November 2022.

33. C.E. Thornton and R.M. Buehrer, "Linear Jamming Bandits: Sample-Efficient Learning for Non-Coherent Digital Jamming," *2022 IEEE Military Communications Conference (MILCOM '22)*, Rockville, MD, November 2022.
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49. C.E. Thornton, R.M. Buehrer and A.F. Martone, "Efficient Online Learning for Cognitive Radar-Cellular Coexistence via Contextual Thompson Sampling," *IEEE 2020 Global Communications Conference, GlobeCom2020*, Taipei, Taiwan, 7-11 December 2020.
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71. C.E. O'Lone and R.M. Buehrer, "Towards a Characterization of Localization Performance in Networks with Random Geometries," *IEEE ICC Workshop on Advances in Network Localization and Navigation (ANLN)*, May 25, 2017, Paris, France.
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211. S. Gollamudi, S. Nagaraj, Y.-F. Huang, and R.M. Buehrer, "Optimal Multistage Interference Cancellation for CDMA Systems Using the MMSE Criterion," *32nd IEEE Conference on Signals, Systems and Computers – Asilomar*, Pacific Grove, CA, vol. 1, pp. 665-669, November 1998.

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213. J.-A. Tsai and R.M. Buehrer, "Frequency Reuse Reduction for IS-136 Using a Four Element Adaptive Array," *8th Virginia Tech Symposium on Wireless Personal Communications*, Blacksburg, VA, pp. 11-22, June 10-12, 1998.
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221. R.M. Buehrer and B.D. Woerner, "Performance of CDMA Multistage Interference Cancellation with Phase and Timing Errors," *1995 IEEE Conference on Universal Personal Communications – UPC'95*, Tokyo, Japan, pp. 153-157, November 6-9, 1995.
222. R.M. Buehrer and B.D. Woerner, "Analysis of Adaptive Multistage Interference Cancellation for CDMA Using an Improved Gaussian Approximation," *1995 IEEE Military Communications Conference*, San Diego, CA, vol. 3, pp. 1195-1199, November 5-8, 1995.
223. A. Park, R.M. Buehrer, and B.D. Woerner, "Throughput Performance for a FHMA System with Variable Rate Coding," *1995 IEEE Military Communications Conference*, San Diego, CA, vol. 1, pp. 320-324, November 5-8, 1995.
224. R.M. Buehrer and B.D. Woerner, "Spread Spectrum for Wireless Communications," *4th Virginia Tech Symposium on Wireless Personal Communications*, Blacksburg, VA, pp. 3-1 – 3-20, June 1994.
225. R.M. Buehrer, S.C. Kwatra, and J. Kim, "A Satellite/Terrestrial Hybrid System for the National Research and Education Network," *15th AIAA International Communications Satellite Systems Conference*, San Diego, CA, March 1994.
226. M. Keaton, R.M. Buehrer, S.C. Kwatra, and J. Kim, "A Wideband Communications Satellite for the National Research and Education Network," *1993 IEEE Global Communications Conference*, Houston, TX, vol. 3, 1644-1648, December 1993.
227. M. Keaton, R.M. Buehrer, S.C. Kwatra, and J. Kim, "Network Requirements for a Satellite Based National Research and Education Network," *1993 IEEE Military Communications Conference*, Boston, MA, vol. 3, pp. 993-997, November 1993.

Technical Reports

National Research Council. 2009. “Toward a Universal Radio Frequency System for Special Operations Forces”, Washington, D.C.: The National Academies Press.

R. M. Buehrer, W.A. Davis, A. Saffai-Jazi, and D. Sweeney, “Ultra-wideband Propagation Measurements and Modeling - Final Report,” submitted to DARPA as part of the NETEX Program.

R. M. Buehrer, A. Saffai-Jazi, W. A. Davis, D. Sweeney, “Path Loss Calculations for Ultra-wideband Signals in Indoor Environments,” invited contribution to the International Telecommunications Union, Document Number USWP 3K-1, October 26, 2003.

15 technical memoranda in the areas of multiuser detection, intelligent antennas, and OFDM for Bell Labs – Lucent Technologies. Titles and abstracts are proprietary information.

Professional Affiliations

- *Fellow*, Institute of Electrical and Electronics Engineers (IEEE)
- Member, IEEE Communications Society
- Member, IEEE Vehicular Technologies Society
- Member, IEEE Signal Processing Society
- Member, Eta Kappa Nu
- Member, Tau Beta Pi
- Member, Pi Mu Epsilon

Selected Professional Activities

- Organizer, “International Workshop on Signal Reuse for Spectrum Efficiency,” *IEEE DySPAN 2024 Conference*.
- Area Editor, *IEEE Transactions on Wireless Communications*, 2017 - 2022.
- Guest Lead Editor, *IEEE Journal on Special Topics in Signal Processing*, special issue on non-cooperative position location networks.
- Guest Editor, *Proceedings of the IEEE*, special issue on cooperative localization.
- Associate Editor, *IEEE Wireless Communications Letters*, 2010 - 2014
- Associate Editor, *IEEE Transactions on Communications*, 2009 - 2014
- Associate Editor, *IEEE Transactions on Wireless Communications*, 2005 - 2012, 2015 - 2017
- Associate Editor, *IEEE Transactions on Vehicular Technologies*, 2005 - 2009
- Associate Editor, *IEEE Transactions on Signal Processing*, 2006-2007
- Associate Editor, *IEEE Transactions on Education*, 1997-2000
- Organizer and Technical Co-Chair, 2015 IEEE Global Communications Conference Workshop on Localization and Tracking: Indoors, Outdoors and Emerging Networks (GC - LION ‘15), December 6, 2015.

- “Signal Processing for Communications” symposium co-chair for IEEE ICC 2017
- Symposium co-chair for IEEE ICC 2017 Signal Processing for Communications Symposium
- Technical Program Co-Chair, WPNC 2013.
- Technical Program Chair for UWBST2003.
- Technical Program Committee, 2008-2016 IEEE Global Communications Conference
- Technical Program Committee, 2007-2016 IEEE International Conference on Communications
- Technical Program Committee, IEEE RWS 2006
- Technical Program Committee, IEEE 2006 International Conference on Ultra Wideband
- Technical Program Committee, IEEE Vehicular Technology Conference 2006 - Fall
- Technical Program Committee, 2004 IEEE International Workshop on Ultra Wideband Systems / Ultra Wideband Systems and Technologies.
- Technical Program Committee, 2004 IEEE Radio and Wireless Conference (RAWCON), September 2004.
- Technical Program Committee, 2005 Wireless Communications and Networking Conference.
- Reviewer for *IEEE Journal on Selected Areas in Communications*, *IEEE Transactions on Communications*, *IEEE Transactions on Vehicular Technology*, *IEEE Communications Letters*, *IEEE Transactions on Signal Processing*, *ETRI Research Journal*, *Army Research Office*, *State of Tennessee*
- Session Chair, IEEE Vehicular Technology Conference – Fall 2002

Selected Consulting

- Lutron Electronics
 - Provided recommendations on the design and testing of indoor wireless networks, August - Sept. 2019.
 - Evaluated RF coexistence plan, March 2020.
 - Evaluated RF coverage and planning techniques for 2.4GHz indoor networks, September - October 2021.
- Polaris Wireless - Provided an evaluation of Z-axis estimation algorithm, Sept-Oct 2018.
- ENSCO, Inc. – Provided an evaluation of spread spectrum ranging system. March 2011.
- FCC – Delivered short courses on various topics in wireless communications including WiFi, spread spectrum, and 3G technologies. Summer 2004, Summer 2005.

Selected Expert Witness Experience

- Varia Holdings vs. Apple, Inc.
 - Law firm: Gibson, Crutcher and Dunn
 - Represented: Apple
 - Served as expert witness. Wrote declaration for claim construction. **Was deposed.**
 - Technology: Emulated RFID
 - Dates: May 2024 - present.
- NXP, et. al. vs. Bell Northern Research
 - Law firm: DLA Piper
 - Represented: NXP (petitioner)
 - Served as expert in Inter Partes Review proceedings. Wrote declaration supporting petitioner.
 - Technology: Training signals in WiFi
 - Dates: May 2024 - present.
- Neo Wireless, LLC v. American Honda Motor Co. Inc.
 - Law firm: Fish and Richardson
 - Served as expert in Inter Partes Review proceedings. Wrote declaration supporting petitioner. Served as an expert witness for litigation including validity and infringement analysis. **Was deposed.**
 - Technology: Cellular communication systems
 - Dates: January 2023 - present
- NXP, et. al. vs. Bell Northern Research
 - Law firm: DLA Piper
 - Represented: NXP (later other members of JDG including MediaTek, ASUSTek, Laird Connectivity)
 - Analyzed technical aspects of several patents to aid validity/invalidity analysis. ITC case. **Was deposed.**
 - Technology: Various aspect of WiFi
 - Dates: August 2023 - April 2024.
- Apple, Inc. vs. The Holding Company LLC
 - Law firm: erise IP
 - Represented: Apple (Petitioner)
 - Served as expert in Inter Partes Review proceedings. Wrote declaration supporting petitioner.
 - IPR2024-00400, IPR2024-00400, IPR2024-00399, IPR2024-00398, IPR2024-00397
 - Technology: Geolocation using wireless devices and wireless networks
 - Dates: April 2023 - present
- Cisco, Inc. vs. Netsocket
 - Law firm: Haynes and Boone
 - Represented: Cisco (Petitioner)
 - Served as expert in Inter Partes Review proceedings. Wrote declaration supporting petitioner. **Was deposed.**
 - IPR2023-00606

- Technology: Quality of Service in wireless/wireline networks
- Dates: Sept. 2022 - December 2023
- Intel
 - Law firm: Wilmer and Hale
 - Represented: Intel
 - Examined technical aspects of various patents to aid validity/invalidity analysis for potential IPR filings.
 - Technology: Multi-user MIMO in WiFi (802.11ac, 802.11ax)
 - Dates: September 2023 - December 2023
- Geoscope vs. Apple
 - Law firm: Gibson, Crutcher and Dunn
 - Represented: Apple
 - Analyzed technical aspects of various patents to aid validity/invalidity and infringement/non-infringement analysis with respect to ITC case. **Was deposed**
 - Technology: Geolocation in 3GPP-based cellular systems.
 - Dates: April 2023 - August 2023
- Ericsson vs. Apple
 - Law firm: Fish and Richardson
 - Represented: Apple
 - Analyzed technical aspects of various patents to aid validity/invalidity and infringement/non-infringement analysis. Included both Inter Partes Review proceedings and ITC case. **Was deposed multiple times. Testified at trial.**
 - Dates: September 2021 - December 2022
- Godo Kaisha IP Bridge vs. Nokia
 - Law firm: Alston & Bird
 - Represented: Nokia (defendant)
 - Served as expert witness for non-infringement and invalidity.
 - Case No. 2:21-CV-215-JRG
 - Technology: Sounding Reference Signal, RACH, ACK/NACK and CQI reporting in cellular networks. **Was deposed.**
 - Dates: September 2021 - November 2022
- Honeywell, Int'l., Inc., et. al. vs. Sisvel International
 - Law firm: K&L Gates
 - Represented: Honeywell (Petitioner)
 - Served as expert in Inter Partes Review proceedings. Wrote declaration supporting petitioner. **Was deposed.**
 - IPR2021-00640
 - Technology: Cell selection and reselection in Radio Resource Control
 - Dates: December 2021 - Jan. 2022
- Thales, et. al. vs. Sisvel International
 - Law firm: AddyHart

- Represented: Thales (Petitioner)
- Served as expert in Inter Partes Review proceedings. Wrote declarations supporting petitioner. **Was deposed.**
- IPR2021-00639
- Technology: Data connection management.
- Dates: December 2021 - Jan. 2022
- ZTE, et. al. vs. Sisvel International
 - Law firm: Banner-Witcoff
 - Represented: ZTE (Petitioner)
 - Served as expert in Inter Partes Review proceedings. Wrote declarations supporting petitioner.
 - IPR2021-00639, IPR2021-00640
 - Technology: Cell selection and reselection in Radio Resource Control; Data connection management.
 - Dates: January 2021 - April 2021
- HP, Inc. vs. Ozmo
 - Law firm: DLA-Piper
 - Represented: HP
 - Served as testifying expert
 - 6:21-cv-00383-ADA
 - Technology: Wireless local area and personal area networks (WLANs and WPANs)
 - Dates: August 2021 - October 2021
- Samsung vs. Ericsson
 - Law firm: Fish & Richardson
 - Represented: Samsung
 - Wrote declarations for IPR filings.
 - IPR2021-00615, IPR2021-00685
 - Technology: Cellular communications
 - Dates: January 2021 - April 2021
- Tesla, Inc. vs. Optis
 - Law firm: Munger, Tolles, & Olson
 - Represented: Tesla (defendant)
 - Case 2:20-cv-00310
 - Served as testifying expert witness
 - Technology: Control channels/information in cellular systems
 - Dates: November 2020 - March 2021
- Apple, Inc.
 - Law firm: Wilmer-Hale
 - Wrote declaration in support of request for ex parte reexamination
 - Reexam Control Number 90/014,653
 - Technology: Control information in cellular systems

- Dates: November 2020 - January 2021
- Phillips vs. Garmin
 - Law firm: Alston-Bird
 - Represented: Garmin (defendant)
 - Served as testifying expert witness for Federal Trade Commission proceedings
 - Technology: Local and Cellular Wireless Connections in Personal Emergency Response Systems
 - District: FTC
 - Dates: June - July 2020
- ZTE vs. Sisvel International
 - Law firm: Banner-Witcoff
 - Represented: ZTE (Petitioner)
 - Served as expert in Inter Partes Review proceedings. Wrote declarations supporting petitioner. **Was deposed.**
 - IPR2020-01070, IPR2020-01071
 - Technology: Radio Resource Control
 - Dates: March 2020 - May 2021
- Apple, Inc. vs. Optis
 - Law firm: Wilmer-Hale
 - Represented: Apple (Plaintiff)
 - Served as testifying expert witness for litigation. **Was deposed. Testified at trial.**
 - Case 2:19-cv-66 (E.D. Tex.)
 - Technology: Control information in cellular systems
 - District: Eastern District of Texas
 - Dates: July 2019 - August 2020.
- Apple, Inc. vs. Wi-LAN
 - Law firm: DLA Piper
 - Represented: Apple (Plaintiff)
 - Served as testifying expert witness for litigation. **Was deposed. Testified at trial.**
 - Technology: Resource Allocation in Wireless Systems
 - District: Southern District of California
 - Dates: January '19 - January '20
- TELUS Communications, Bell Mobility, and Rogers Communications vs. WiLAN, Inc.
 - Law firm: Torys, LLP.
 - Represented: TELUS Communications, Bell Mobility, and Rogers Communications
 - Served as testifying expert. Analyzed certain patents (and the prior art) and provided technical reports on sufficiency, validity and potential double-patenting.
 - Technology: Resource allocation in wireless networks
 - Dates: January 2019 - November 2019
- Samsung vs. Sharp

- Law firm: Fish and Richardson
 - Represented: Samsung
 - Analyzed technical aspects of patent to aid validity/invalidity analysis.
 - Technology: Feedback in MIMO-OFDM systems
 - Dates: April 2019 - July 2019
- American Patents, LLC vs. HP, Inc.
 - Law firm: DLA Piper
 - Represented: HP, Inc.
 - Analyzed technical aspects of two patents to aid validity/invalidity analysis.
 - Case 18-cv-700 (E.D. Tex.)
 - Technology: MIMO/OFDM synchronization in cellular systems
 - Dates: June 2019
- Blackberry vs. Uniloc, LLC.
 - Law firm: Oblon
 - Represented: Blackberry (Petitioner)
 - Wrote declaration to the USPTO concerning the disclosure of certain features of two patents in previous references.
 - Technology: Traffic mapping between logical channels and transport channels in wireless systems
 - Dates: June 2019.
- Apple, Inc. vs. Wi-LAN
 - Law firm: DLA Piper
 - Represented: Apple (Plaintiff)
 - Served as testifying expert witness for litigation (non-infringing alternatives). **Was deposed. Testified at trial.**
 - Case 3:14-cv-2235-DMS-BLM
 - Technology: Resource Allocation in Wireless Systems
 - District: Southern District of California
 - Dates: November '17 - July '18
- Apple, Inc., LG Electronics Inc., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. vs. Uniloc, LLC.
 - Law firm: Fish and Richardson
 - Represented: Apple, Inc., LG Electronics Inc., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (Petitioner)
 - Wrote declarations to the USPTO concerning the disclosure of certain features of two patents in previous references.
 - IPR2019-00219, IPR2019-00222
 - Technology: Traffic mapping between logical channels and transport channels in Wireless Systems; Multi-mode transceivers
 - Dates: September 2018 - November 2019.
- CCE vs. Apple, Inc.

- Law firm: DLA Piper
- Represented: Apple (Defendant)
- Served as testifying expert witness for litigation (infringement analysis). **Was deposed.**
- 2:15-cv-00576-RWS-RSP
- Technology: Power Headroom Reporting in Cellular Systems
- District: Eastern District of Texas
- Dates: January 2017 - July 2017
- Nokia Technologies vs. Apple, Inc.
 - Law firm: Wilmer-Hale
 - Represented: Apple (Defendant)
 - Served as testifying expert witness for litigation (infringement analysis)
 - Technology: antennas for handheld mobile devices
 - District: Eastern District of Texas
 - Dates: January 2017 - June 2017
- Core Wireless vs. Apple, Inc.
 - Law Firm: Wilmer-Hale
 - Represented: Apple (Defendant)
 - Role: Served as testifying expert witness for litigation (infringement and validity analysis). **Was deposed. Testified at trial.**
 - Case 5:15-cv-5008
 - Technology: Control Channels and Frame Stealing in 2G (GSM) cellular networks.
 - District: The US District Court for the Northern District of California
 - Dates: May 2015 - December 2016.
- AMERICAN SYSTEMS vs. US Navy
 - Law Firm: Miles and Stockbridge
 - Represented: AMERICAN SYSTEMS (Plaintiff)
 - Role: Served as testifying expert witness for litigation (case settled prior to expert reports being filed).
 - Technology: Wireless mesh networks.
 - Dates: Nov. 2014 - June 2015.
- TruPosition, Inc. vs. LM Ericsson Telephone Company, et. al.
 - Law Firm: Constantine-Cannon LLP
 - Represented: TruePosition (Plaintiff)
 - Role: Served as testifying expert witness for litigation. Case settled prior to depositions being taken.
 - Case 2:11-cv-04574-RK
 - Technology: Cellular-based geolocation for 4G (LTE) cellular networks.
 - District: The US District Court for the Eastern District of Pennsylvania
 - Dates: March 2013 - July 2014.
- Andrew, LLC vs TruPosition, Inc.
 - Law Firm: Patterson Belknap Webb & Tyler LLP

- Represented: Andrew, LLC (Plaintiff)
- Role: Served as testifying expert witness for patent litigation. **Was deposed.**
- Civil Action 09-669
- Technology: Cellular-based (2G, 3G) geolocation.
- District: The US District Court for the District of Delaware
- Dates: Nov. 2009 - March 2010.
- TCL vs. Ericsson
 - Law Firm: Sheppard Mullin
 - Provided Services for: TCL (Plaintiff)
 - Role: Served as consulting expert witness for essentiality analysis.
 - Technology: digital communications in 2G, 3G, and 4G cellular systems.
 - District: The US District Court for the Central District of California
 - Dates: March 2015 - December 2015.
- Univ. of Minnesota vs. Sprint
 - Law Firm: McGuire-Woods
 - Provided Services for: Sprint (Defendant)
 - Role: Served as consulting expert for validity analysis.
 - Technology: 4G cellular networks.
 - Dates: October 2015 - January 2016.
- Eon Corp, IP Holdings, LLC vs Research In Motion Corporation, et. al.
 - Law Firm: Sidley-Austin
 - Provided Services for: Research in Motion Corporation (Defendant)
 - Served as consulting expert for patent litigation
 - Technology: Cellular technologies
 - Dates: March 2012
- InterDigital vs. Nokia
 - Law Firm: Alston-Bird LLP
 - Provided Services for: Nokia
 - Served as a consulting expert
 - Technology: Cellular CDMA and power control
 - Date: Oct. 2011 - Dec. 2011.
- SPH America, LLC vs Acer, Inc.
 - Law Firm: Spotts Fain PC
 - Provided Services for: UT Starcomm
 - Role: Served as a consulting expert for patent litigation
 - Technology: CDMA (spread spectrum) and 3G cellular technologies.
 - Dates: Jan. 2011 - March 2011

References

Available upon request.