

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner

v.

DH INTERNATIONAL LTD.
Patent Owner

Case No. IPR2025-00172
U.S. Patent No. 9,022,294

**DECLARATION OF DR. MICHAEL BUEHRER
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,022,294**

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CLAIM LISTING

Claim 1:

Claim 1(Pre): A cellular phone, comprising:

1(a) an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output;

1(b) a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, with said invariable activation command being issued when said control device is selectively triggered by the user;

1(c) a first data transceiver operatively linked to said electronic circuit, said first data transceiver being for exchanging data between said electronic circuit and a first external data exchange device over a first communication link;

1(d) a second data transceiver operatively linked to said electronic circuit, said second data transceiver being for exchanging data between said electronic circuit and a second external data exchange device over a second communication link that is distinct from said first communication link;

1(e) a cue receiver operatively linked to said electronic circuit for receiving an activation cue from a source external to said cellular phone;

1(f) a data conveyance switching element operatively linked to said electronic circuit, said switching element being assigned a first state upon an activation cue having been received by said cue receiver, and being assigned a second state when no activation cue was received by said cue receiver; and;

1(g) power means for providing power to said portable electronic device cellular phone;

1(h)(i) wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if said switching element is in said first state, a first data conveyance operation will be initiated through the instrumentality of said first data transceiver for sending data from said electronic circuit to the first external data exchange device over said first communication link;

1(h)(ii) if said switching element is in said second state, a second data conveyance operation will be initiated through the instrumentality of said second data transceiver for sending data from said electronic circuit to the second external data exchange device over said second communication link.

Claim 2:

A cellular phone as defined in claim 1, further comprising a display screen operatively linked to said electronic circuit.

Claim 3:

A cellular phone as defined in claim 1, wherein said first data transceiver includes said cue receiver.

Claim 4:

A cellular phone as defined in claim 1, wherein said control device is one of a manually activated button, a keypad for receiving a PIN code, a biometric parameter detector and a combination thereof.

Claim 5:

A cellular phone as defined in claim 1, wherein said electronic circuit includes said switching element.

Claim 6:

A cellular phone as defined in claim 5, wherein said electronic circuit comprises a microchip, and wherein said switching element is a series of instructions programmed onto said microchip.

Claim 7:

A cellular phone as defined in claim 1, wherein said switching element comprises a logical circuit.

Claim 8:

A cellular phone as defined in claim 1, wherein said first data transceiver comprises a proximity transceiver for accomplishing a wireless data exchange with a first external data exchange device through a direct link representing said first communication link where the cellular phone is conveyed toward a close proximity of the first external data exchange device and within a range to receive the activation cue to initiate the wireless data exchange.

Claim 9:

A cellular phone as defined in claim 8, wherein said second data transceiver comprises a communication network transceiver for wireless communication through a communication network that represents said second communication link, with one of a remote portable electronic device, a remote server, a remote terminal and a combination thereof.

Claim 10:

Claim 10(Pre): A cellular phone comprising:

10(a) an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output;

10(b) a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after

being operated issue an invariable activation command, with said invariable activation command being issued when said control device is triggered by the user;

10(c) first and second data conveyance operations programmed in said electronic circuit;

10(d) a first data transceiver operatively linked to said electronic circuit, said first data transceiver being operable for data exchange over a first communication link;

10(e) a second data transceiver operably linked to said electronic circuit, said second data transceiver being operable for data exchange over a second communication link that is distinct from said first communication link;

10(f) a cue receiver operatively linked to said electronic circuit for receiving an activation cue from a source external to said cellular phone; and

10(g) power means, for providing power to said cellular phone;

10(h)(i) wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if an activation cue was received by said cue receiver, said electronic circuit will accomplish said first data conveyance operation to convey data from said electronic circuit to said first data transceiver for transmitting data through said first data transceiver; and

10(h)(ii) wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if no activation cue was received

by said cue receiver, said electronic circuit will accomplish said second data conveyance operation to convey data from said electronic circuit to said second data transceiver for transmitting data through said second data transceiver.

Claim 11:

Claim 11(Pre): A data exchange system comprising:

11(a) a first data exchange device;

11(b) a second data exchange device; and

11(c) a cellular phone, including:

11(c)(i) an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output;

11(c)(ii) a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, with said invariable activation command being issued when said control device is selectively triggered by the user;

11(c)(iii) a first data transceiver operatively linked to said electronic circuit, said first data transceiver being for exchanging data between said electronic circuit and said first data exchange device through a direct link;

11(c)(iv) a second data transceiver operatively linked to said electronic circuit, said second data transceiver being for exchanging data between said electronic circuit and said second data exchange device through a communication network that is distinct from said direct link;

11(c)(v) a cue receiver operatively linked to said electronic circuit for receiving an activation cue from said first data exchange device;

11(c)(vi) a data conveyance switching element operatively linked to said electronic circuit, said switching element being assigned a first state upon an activation cue having been received by said cue receiver, and being assigned a second state when no activation cue was received by said cue receiver; and

11(c)(vii) power means for providing power to said cellular phone;

11(c)(viii)(A) wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if said switching element is in said first state, a first data conveyance operation will be initiated through the instrumentality of said first data transceiver for exchanging data between said electronic circuit and the first external data exchange device;

11(c)(viii)(B) if said switching element is in said second state, a second data conveyance operation will be initiated through the instrumentality of said second data transceiver for exchanging data between said electronic circuit and the second external data exchange device.

Claim 12:

Claim 12(Pre) A method for data conveyance with a cellular phone of the type comprising: an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output, a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, first and second data transceivers operatively linked to said electronic circuit, a cue receiver operatively linked to said electronic circuit, a data conveyance switching element operatively linked to said electronic circuit and capable of being in either one of a first and a second state, and power means for providing power to said cellular phone, said method comprising the steps of:

12(a) awaiting for an activation cue to be received at said cue receiver;

12(b) if an activation cue is received at said cue receiver, assigning said first state to said switching element, while if no activation cue is received at said cue receiver, assigning said second state to said switching element; and

12(c) a user selectively triggering said control device to issue an invariable activation command whereby:

12(d)(i) if said switching element is in said first state, forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device over a first communication link; and

12(d)(ii) if said switching element is in said second state, forwarding second data to said second data transceiver for initiating a data exchange operation with a second external data exchange device that is distinct from said first communication link.

Claim 13:

A method as defined in claim 12, further comprising the following step before the step of forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device:

forwarding third data to and displaying said third data on a display screen provided on said cellular phone, wherein said third data is representative of the content of said first data.

Claim 14:

A method as defined in claim 13, wherein after the step of forwarding said third data to the display screen, the method comprises the following step:

awaiting for an authorization command to be inputted through a user confirmation input device provided on said cellular phone before forwarding said first data to said first data transceiver.

Claim 15:

A method as defined in claim 12, wherein said first and second data are identical.

Claim 16:

A method as defined in claim 12, wherein said first data transceiver is a proximity transceiver and the step of forwarding said first data to said first transceiver is for initiating a wireless data exchange operation with a proximate first external data exchange device through a direct link representing said first communication link where the cellular phone is conveyed toward a close proximity of the first external data exchange device and within a range to receive the activation cue to initiate the wireless data exchange.

Claim 17:

A method as defined in claim 12, wherein said second data transceiver is a communication network transceiver and the step of forwarding said second data to said second data transceiver is for initiating a wireless data conveyance operation through a communication network representing said second communication link, with one of a remote portable electronic device, a remote server, a remote terminal and a combination thereof.

Claim 18:

A method as defined in claim 12, wherein the step of selectively triggering said control device to issue the invariable activation command comprises selectively triggering one of the manually activated button, the keypad for receiving a PIN code, the biometric parameter detector and a combination thereof.

Claim 19:

Claim 19(Pre) A method for data conveyance with a cellular phone of the type comprising: an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output, a control device operatively linked to said electronic circuit, first and second data transceivers operatively linked to said electronic circuit, a cue receiver operatively linked to said electronic circuit, a data conveyance switching element operatively linked to said electronic circuit and capable of being in either one of a first and a second state, and power means for providing power to said cellular phone, said method comprising the steps of:

19(a) awaiting for an activation cue to be received at said cue receiver;

19(b) if an activation cue is received at said cue receiver, assigning said first state to said switching element, while if no activation cue is received at said cue receiver, assigning said second state to said switching element; and

19(c) selectively triggering said control device to issue an invariable activation command whereby:

19(c)(i) if said switching element is in said first state, forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device over a first communication link; and

19(c)(ii) if said switching element is in said second state, forwarding second data to said second data transceiver for initiating a data exchange operation with a second external data exchange device over a second communication link that is distinct from said first communication link;

19(d)(i) wherein said method further comprises the following steps before the step of forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device: forwarding third data to and displaying said third data on a display screen provided on said cellular phone, wherein said third data is representative of the content of said first data; and

19(d)(ii) awaiting for an authorization command to be inputted through a user confirmation input device provided on said cellular phone before forwarding said first data to said first data transceiver; and

19(e)(i) wherein said method further comprises the following steps before the step of forwarding second data to said second data transceiver for initiating a data exchange operation with a second external data exchange device: forwarding fourth data to and displaying said fourth data on said display screen, wherein said fourth data is representative of the content of said second data; and

19(e)(ii) awaiting for an authorization command to be inputted through said user confirmation input device before forwarding said second data to said second data transceiver.

Claim 20:

A method as defined in claim 19, wherein said control device includes said user confirmation input device.

I, Dr. Michael Buehrer, declare the following:

I. INTRODUCTION

1. I am over the age of 21 and am competent to make this declaration. I make this declaration based on facts and matters within my own knowledge and on information provided to me by others, and, if called as a witness, I could and would competently testify to the matters set forth herein.

A. Educational Background and Professional Experience

2. My qualifications are stated more fully in my curriculum vitae, which is attached as Appendix A. Below is a summary of my education, work experience, and other qualifications

3. I am currently a Professor of Electrical Engineering and the former (2014-2022) Director of *Wireless @ Virginia Tech*.

4. My academic and professional background is in Electrical and Computer Engineering, and I have been working in those fields since the completion of my Ph.D. over 25 years ago. Below, I provide a short summary of my education and experience that I believe to be most pertinent to the opinions I have formed in this case.

5. I received a B.S. in Electrical Engineering from The University of Toledo in 1991, an M.S. in Electrical Engineering from The University of Toledo in 1993, and a Ph.D. in Electrical Engineering from Virginia Polytechnic Institute and

State University in 1996. The focus of my graduate work was wireless communication systems. My Ph.D. thesis involved the application of multiuser detection (an advanced signal processing approach to interference mitigation) to CDMA-based cellular systems.

6. After completion of my Ph.D. in 1996, I joined Bell Laboratories, the research division of Lucent Technologies, where I worked for five years as a Member of Technical Staff and later as a Distinguished Member of Technical Staff. My work there focused on developing advanced technologies for cellular telecommunications, including for 3G cellular standards. For example, while at Bell Labs, I developed and implemented algorithms for intelligent antenna systems that increased the voice capacity (i.e., number of simultaneous phone calls) and data capacity of cellular systems. These algorithms were included in Lucent Technologies' 3G CDMA cellular base station. I also developed techniques known as transmit diversity techniques that increased reliability (i.e., reduced the probability of a dropped call) of cellular systems. These transmit diversity techniques were standardized in the 3GPP2 cellular standard known as cdma2000. During that time, I supported the standardization of my ideas by writing contributions to the working groups developing the standards and attending standards meetings. In particular, I participated in the 3GPP2 standardization

process. During that time, I worked with colleagues to include my ideas on the use of transmit diversity in CDMA systems in the 3GPP2 standard.

7. I am currently a Professor in the Bradley Department of Electrical and Computer Engineering at Virginia Polytechnic Institute and State University, where I have taught and conducted research in the area of wireless communications, geolocation and radar for over 20 years. Specifically, I have taught courses that cover wireless communications and signal processing (including the underlying concepts) at the undergraduate and graduate levels. For example, I teach a sophomore-level course which introduces the concepts of signals and systems, a junior-level course which introduces the basic concepts of communication systems, senior-level and graduate-level courses that cover advanced digital communication topics, and also graduate-level courses that teach the advanced technologies underlying the latest wireless systems, such as Fourth and Fifth Generation (4G/5G) cellular communication standards (e.g., LTE, LTE-Advanced, New Radio) and Wi-Fi. I also teach graduate courses on advanced topics such as Information Theory, Machine Learning Applied to Communication Systems, Spread Spectrum Communications and CDMA. Furthermore, I have taught short courses covering topics such as position location and position location using ultra-wideband signals.

8. Additionally, I have conducted research into Ultra-Wideband (UWB) signal propagation, UWB receiver design, and UWB signal processing across a

number of funded research projects. I also developed a UWB-based ranging system as part of an automated cargo container transfer system for the United States Navy. Further, I have developed geolocation systems in a number of research projects including designing a prototype system for localizing first responders, developing localization techniques for 5G and 6G cellular networks, localization sub-systems for in-home smart health systems, algorithms for enhancing cellular-based localization, algorithms for localization in the presence of interference and harsh propagation, and a second UWB-based positioning system.

9. From 2014 until 2022, I also served as the director of *Wireless @ Virginia Tech*, a comprehensive research group focusing on wireless communications, which consists of 14 faculty members and approximately 85 graduate students. My specific research focuses on advanced wireless communications and geolocation techniques. This research has examined both advanced theoretical concepts as well as the application of these concepts to the latest wireless standards. As an example of the latter, I (along with my students) have conducted research applying multiuser/multi-antenna signal processing to LTE. I have also applied advanced geolocation techniques to LTE systems.

10. My research work has been funded by national agencies including the National Science Foundation (NSF), the Defense Advanced Research Projects

Agency (DARPA), the Office of Naval Research (ONR), the Army Research Lab, the Air Force Research Lab as well as many industrial sponsors.

11. During 2009, I was a visiting researcher at the Laboratory for Telecommunication Sciences (LTS), a Federal Research Lab that focuses on telecommunication challenges for national defense. While at LTS, my research focus was in the area of cognitive radio with a particular emphasis on statistical learning techniques.

12. I have authored and co-authored over 300 publications in my area of expertise, which have been published in the leading journals in my field including *IEEE Transactions on Communications*, *IEEE Transactions on Wireless Communications*, *IEEE Transactions on Information Theory*, *Proceedings of the IEEE*, and *IEEE Transactions on Signal Processing*, and at all of the major conferences in my field. These publications include the areas of wireless position location (i.e., geolocation). This research has been cited over 12,000 times. A complete list of my publications over the last 30 years is included in my Curriculum Vitae. I am a Fellow of the IEEE (so named “for contributions to wideband signal processing in communications and geolocation”). Additionally, in 2023 I received the prestigious MILCOM Lifetime Award for Technical Achievement. This award recognizes individuals who have made important technical contributions to military communications over the course of their careers. Earlier this year I was a co-

recipient of both the Vanu Bose Award for the best paper and the Fred Ellersick Award for the best paper, both at the 2023 Military Communications Conference. I was also a co-recipient of the Vanu Bose Award for the best paper at the 2021 Military Communications Conference.

13. In 2010, I was awarded the Ellersick Best Paper Award in the Unclassified Technical Program, at the IEEE Military Communications Conference. I received the SDR Forum Best Paper Award in 2007 and the Outstanding Paper Award at the SDR Forum in 2008. I received the Dean's Award for Teaching Excellence in April 2014 and the Dean's Award for Outstanding New Assistant Professor, College of Engineering in 2003. While at Bell Laboratories, I was awarded the Bell Labs President's Silver Award for outstanding research contributions and the 1999 Best Paper Award in the Bell Labs Technical Journal.

14. I also hold 18 issued patents in the area of wireless communications, many of which relate to wirelessly locating a wireless device.

15. I formerly served as an area editor for *IEEE Transactions on Wireless Communications* supervising a team of 12 editors. I also recently served as a guest editor for a special issue of the *Proceedings of the IEEE* and as a guest lead editor for a special issue of the *IEEE Journal on Special Topics in Signal Processing* relating to non-cooperative position location networks. I was formerly an associate editor for *IEEE Wireless Communications Letters*, *IEEE Transactions on Vehicular*

Technologies, IEEE Transactions on Communications, IEEE Transactions on Signal Processing, and IEEE Transactions on Education.

16. Additionally, I formerly served as the guest editor for the *IEEE Journal on Special Topics in Signal Processing*. I served as the Technical Program Chair for the Signal Processing for Communications Symposium at the 2017 IEEE International Conference on Communications. Previously, I was the Organizer and Technical Co-Chair for both the 2015 and 2016 IEEE Global Communications Conference Workshop on Localization and Tracking: Indoors, Outdoors and Emerging Networks (LION). I have also served on the technical program committees of several other conferences and workshops in my field.

17. My opinions are based on my years of education, research, and experience, as well as my study of relevant materials. In forming my opinions, I have also considered the materials identified in this declaration and in the Petition.

18. My compensation is not dependent on the outcome of these proceedings or the content of my opinions. To the best of my knowledge, I have no financial interest in either party or in the outcome of this proceeding.

II. METHODOLOGY AND MATERIALS CONSIDERED

19. I have relied upon my education, knowledge and experience with the technology of wireless communications, as well as the other materials as discussed in this declaration in forming my opinions.

20. For this work, I have been asked to review U.S. Patent No. 9,022,294 (“’294 Patent”) (Ex. 1001) and the ’294 Patent’s prosecution history (“’294 File History”) (Ex. 1003). My opinions support Apple Inc.’s petition for *Inter Partes* Review, which challenges all 20 claims of the ’294 Patent (“Challenged Claims”). In developing my opinions relating to the ’294 Patent, I have considered the materials cited or discussed herein, including those listed below.

Exhibit 1001	U.S. Patent No. 9,022,294 (“the ’294 Patent”)
Exhibit 1002	U.S. App. No. 10/552,912
Exhibit 1003	File History for U.S. Patent No. 9,022,294
Exhibit 1005	Japanese Patent No. 2003110751 to Suga (“ <i>Suga</i> ”)
Exhibit 1006	International Patent Application Publication No. WO 2001/22662 to Gorsuch (“ <i>Gorsuch</i> ”)
Exhibit 1007	U.S. Patent No. 8,792,454 to Taniuchi et al. (“Taniuchi”)
Exhibit 1008	U.S. Patent No. 8,165,559 to Klesper et al. (“ <i>Klesper</i> ”)
Exhibit 1009	Nokia Corporation, Nokia 6136 User Guide, 9252766 Issue 2, copyright 2007
Exhibit 1010	U.S. Patent Publication No. 2007/0277120 to Wilson et al.
Exhibit 1011	Feng Zhang, <i>Vertical Handoff Between 3G Networks and WLANS</i> , copyright 2005
Exhibit 1012	Al Sacco, The Eight Hottest Smartphones of 2008, computerworld.com, https://www.computerworld.com/article/1367892/the-eight-hottest-smartphones-of-2008.html
Exhibit 1013	U.S. Patent No. 7,660,854 to Sorotzkin (“ <i>Sorotzkin</i> ”)
Exhibit 1014	U.S. Patent No. 6,671,718 to Meister et al. (“ <i>Meister</i> ”)
Exhibit 1016	Nokia N93 User Guide

21. I have considered these materials from the viewpoint of a POSITA as of the priority date of the ’294 Patent. For the purposes of this declaration, I apply the priority date of the ’294 Patent as October 21, 2009 for the reasons discussed in

Section VII. I note that my opinions provided in this declaration are made from the perspective of a POSITA as of this priority date of the '294 Patent, unless expressly stated otherwise. To the extent that I use any verb tense in this declaration that is present tense (e.g., “a POSITA would understand” instead of “a POSITA would have understood”), such verb tense should be understood to be my opinion as of the '294 Patent's priority date (again, unless expressly stated otherwise). I merely use the present verb tense for ease of reading.

III. OVERVIEW AND LEGAL STANDARDS

22. In formulating my opinions, I have been instructed to apply certain legal standards. I am not a lawyer. I do not expect to offer any testimony regarding what the law is. Instead, the following sections summarize the law as I have been instructed to apply it in formulating and rendering my opinions found later in this declaration. I understand that, in an *inter partes* review (“IPR”) proceeding, patent claims may be deemed unpatentable if it is shown that they were anticipated or rendered obvious in view of the prior art. I understand that prior art in an IPR review is limited to patents or printed publications that predate the priority date of the patent at issue. I understand that questions of claim clarity (definiteness) and enablement cannot be considered as a ground for considering the patentability of a claim in these proceedings.

A. Person of Ordinary Skill in the Art

23. I understand that the '294 Patent, the record of proceedings at the Patent Office (which I understand is called the "File History" or "Prosecution History"), and the teachings of the prior art are evaluated from the perspective of a person of ordinary skill in the art ("POSITA") at the time the claimed invention was made. I understand that the factors considered in determining the ordinary level of skill in the art include: (i) the levels of education and experience of persons working in the field; (ii) the types of problems encountered in the field; and (iii) the sophistication of the technology. I may also consider, if available, the education level of the inventor, prior art solutions to the problems encountered in the art, and the rapidity with which innovations are made in the relevant art.

24. I understand that a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors above. This hypothetical person has knowledge of all prior art in the relevant field as if it were arranged on a workshop wall and takes from each reference what it would teach to a person having the skills of a POSITA.

B. Obviousness

25. I understand that a claim may be invalid under 35 U.S.C. § 103(a) if the subject matter described by the claim as a whole would have been "obvious" to a hypothetical POSITA in view of a single prior art reference or in view of a

combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical POSITA. I further understand that a hypothetical POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit and all analogous prior art. I understand that obviousness in an IPR review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

26. I also understand that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole. I understand that in considering whether an invention for a claimed combination would have been obvious, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a POSITA. I also understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a POSITA can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls;

- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a POSITA will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A POSITA is also a person of ordinary creativity, and is not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a POSITA would have had good reason to pursue the known options within his or her technical grasp; and

- One should not use hindsight in evaluating whether a claimed invention would have been obvious.

27. I also understand that an obviousness determination includes the consideration of various factors such as: (1) the scope and content of the prior art, (2) the differences between the prior art and the asserted claims, (3) the level of ordinary skill in the pertinent art, and (4) the existence of secondary considerations such as commercial success, long-felt but unresolved needs, failure of others, and so forth.

28. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of ordinary skill in the relevant art, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. I also am informed, however, that a reference does not teach away if it merely expresses a general preference for an alternative invention but does

not criticize, discredit, or otherwise discourage investigation into the invention claimed.

29. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider “secondary considerations” if presented. In most instances, the patentee raises these secondary considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; and (h) teaching away from the invention in the prior art.

30. I am further informed that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention. The nexus cannot be based on prior art features. The establishment of a nexus is a question of fact. While I understand that Patent Owner here has not offered any secondary considerations at this time, I will

supplement my opinions in the event that Patent Owner raises secondary considerations during the course of this proceeding.

C. Analogous Art

31. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be “analogous art” to the claimed invention. I have been informed that a reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). In order for a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering his problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that all of the references that my opinions in this IPR are based upon are well within the range of references a person having ordinary skill in the art would consult to address the type of problems described in the Challenged Claims.

D. Claim Construction

32. I understand that the claim terms in this IPR will be construed according to their plain and ordinary meaning as understood in light of the claim language, the

patent's description, and the prosecution history viewed from the perspective of a POSITA. I further understand that where a patent defines claim language, the definition in the patent controls, even if there are other definitions that might be understood by those working in the art.

33. I understand that the Petition proposes that the phrase “invariable activation command” should be interpreted broadly enough to capture a command to transmit data through either a first or second data conveyance operation, where the decision of which operation to use is outside of user control. I have adopted this interpretation of “invariable activation command” in my opinions below. For all other claim language, I have applied the plain and ordinary meaning as defined in the preceding paragraph.

IV. LEVEL OF A PERSON OF ORDINARY SKILL

34. Based on my review and analysis of the '294 Patent, the prior art cited herein, and the ordinary skill factors described in this section, a POSITA in the field of the '294 Patent at the time of the earliest possible priority date (October 21, 2009) would have been knowledgeable in the fields of wireless data communication and mobile device design. In my experience working, teaching, and performing research in this field, most workers of ordinary skill in the art as of the earliest possible priority date of October 21, 2009, would have had a bachelor's degree in electrical engineering, computer engineering, or an equivalent, as well as two years of industry

experience and who would have had a working knowledge of wireless communication devices and networks. A person with less, relevant practical experience but with additional education can also qualify as a POSITA in the field of the '294 Patent. When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of October 21, 2009.

35. As of October 21, 2009, I had more than ordinary skill in the art. I am, however, familiar with the skills and knowledge possessed by those I would have considered to be of ordinary skill in the art as of that date. For example, as discussed above, since August 2001, I have held a faculty position at Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, where I have taught and conducted research in the area of wireless communications, geolocation and radar for over 20 years. Specifically, I have taught courses that cover wireless communications and signal processing (including the underlying concepts) at the undergraduate and graduate levels. I hold 18 issued patents in the area of wireless communications and signal processing, many of which relate to wirelessly locating a wireless device. I formerly served as an area editor for *IEEE Transactions on Wireless Communications*, supervising a team of 12 editors. I also recently served as a guest editor for a special issue of the *Proceedings of the IEEE* and as a guest lead editor for a special issue of the *IEEE Journal on Special Topics in Signal Processing* relating to non-cooperative position location networks.

I was formerly an associate editor for *IEEE Wireless Communications Letters*, *IEEE Transactions on Vehicular Technologies*, *IEEE Transactions on Communications*, *IEEE Transactions on Signal Processing*, and *IEEE Transactions on Education*.

36. My opinions provided in this declaration would not change in view of minor modifications to this level of ordinary skill.

V. OVERVIEW OF THE TECHNOLOGY

1. The features described and claimed in the '294 Patent were routine as of October 21, 2009. In the following paragraphs, I briefly summarize the technology background for a few key features relevant to the opinions set forth herein.

A. Cell Phones Capable of Transmission Through Multiple Wireless Networks

37. It was common as of the priority date of the '294 patent for cellular phones to be equipped with multiple distinct transceivers, allowing them to transmit data through either cellular networks or over a Wireless LAN. *See* Ex 1012 (stating the T-Mobile G1 and the Sony Ericsson Xperia 1, support both 3G and Wi-Fi; that the Blackberry Bold supports 3G, Wi-Fi and GSM; the Apple iPhone 3G supports GSM and Wi-Fi; HTC Touch Pro supports CDMA and Wi-Fi); Ex. 1009, 7 (describing the use of the GSM band), 59-63 (describing the WiFi radio and the GPRS radio); Klesper 1:51-57 ("In another recent development, telecommunication service providers have begun to offer dual-mode handsets that are capable of

accessing voice services over both dedicated access systems and open access systems. For example, a dual-mode handset can be configured to communicate with a CDMA network when outside the home, yet switch to communicating with a WiFi network when inside the home.”). At the time, these phones commonly used 3G networks for cellular data communication and Wi-Fi for W-LAN communication. *See* Ex. 1012. For example, the T-Mobile G1, Sony Ericsson Xperia 1, Blackberry Bold, and Nokia E71 are also specifically disclosed to have transmission capabilities over both 3G and Wi-Fi. *Id.*, 2-4. Additionally, cell phones commonly could use other communication networks such as infrared and Bluetooth. *See Id.* A POSITA would have understood that these features were common as of the priority date of the '294 Patent.

B. Switching Between Wireless Networks

38. It was also well established that mobile electronic devices, such as cellular phones, were capable of performing handoffs between different wireless networks. For example, the commercial Nokia 6136 cellular phone included a “seamless handoff of mobile voice and data from a wide area cellular network to WLAN or Wireless Fidelity (Wi-Fi), so it is possible to connect at a high speed to the internet from virtually anywhere.” Ex. 1009, pg. 59. Similarly, U.S. Patent No. 8,165,559 to Klesper et al. (“*Klesper*”) (Ex. 1008) disclosed a “combo phone” that was capable of connecting to an open access point, for example WiFi or WiMax, or

to a cellular network access point to make a call to emergency services. *Klesper*, 8:8-14, Fig. 6. Further, Klesper states that “combo phones, as well as other types of call systems, are well known in the art.” *Klesper*, 5:52-54. Finally, U.S. Patent No. 8,792,454 to Taniuchi et al. (“*Taniuchi*”) (Ex. 1007) teaches a system for seamless roaming between multiple networks for a mobile node. *Taniuchi*, (57), 2:22-24, 1:21-27, Fig. 4; Taniuchi teaches transitioning from a WLAN to a cellular network when the signal strength of the WLAN drops below a predetermined threshold. *Taniuchi*, 16:29-41. As of the priority date of the ’294 Patent, it was common in the art for devices to handoff between different networks.

39. In fact, the idea of vertical handoffs between lower-level wireless systems with smaller coverage areas and upper-level wireless networks with wider coverage has been around since at least 1998. Ex. 1011, 3. It was well known to use W-LAN for data on a mobile device when available, and to switch to a mobile network such as 3G when it is not. *Id.*

VI. THE ’294 PATENT

40. The ’294 Patent is generally directed to “a portable electronic device capable of alternate data conveyance operations responsive to an invariable activation command.” Ex. 1001, 1:16:18, Abstract. One such “portable electronic device” 102, depicted in Fig. 4., includes a “control device 114, an electronic circuit

116, a display screen 118, a first transceiver 120, a second transceiver 122 and power means 124.” *Id.*, 7:26-32, 13:42-47, Fig. 4.

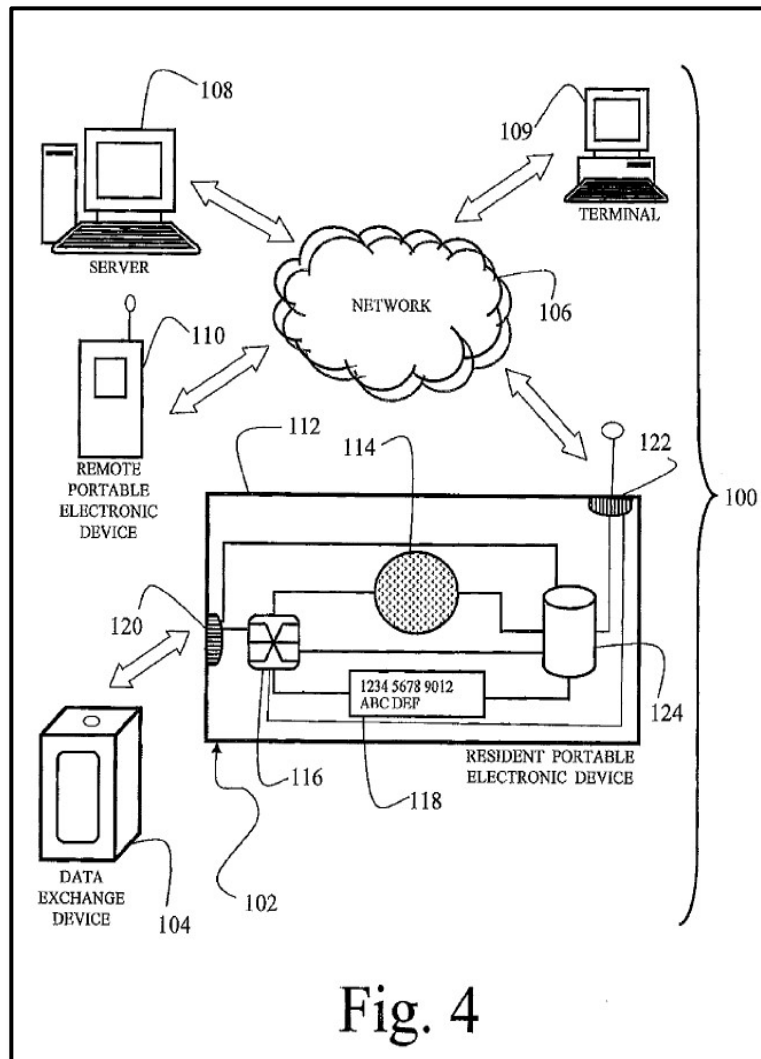


Fig. 4

Id., Fig. 4. “Portable electronic device 102 may be for example a cellular phone[.]”

Id., 13:47-49.

41. The portable electronic device 102 includes a “cue receiver” capable of receiving an “activation cue[.]” *Id.*, 15:4-6. When an activation cue is received, a switching element 116 changes from a default state (e.g., an inactive state) to an

activated state. *Id.*, 3:42-44, 13:55-60. In the absence of an activation cue, the switching element changes to or remains in the default state. *Id.*, 15:4-13.

42. The “control device 114” may be “a single button, a keypad wherein a personal identification number (PIN) code may be entered, a combination thereof or any other suitable control device” that can be selectively triggered to issue an invariable activation command. *Id.*, 13:61-67, 15:14-18. The invariable activation command, in turn, results in one of two data exchange operations depending on the state of the switching element. *Id.*, 2:12-21, 15:4-15. Then, “[u]pon control device 114 having been triggered” the portable device initiates a data conveyance operation that is conducted based on the state of the switching element. *Id.*, 2:12-21, 15:14-23.

43. An example application uses portable device 102 “to accomplish a financial transaction.” *Id.*, 16:8-10. In this application, “the user of portable electronic device 102 will be asked to pay an amount[,]” which may be displayed on display screen 118. *Id.*, 16:24-26, 16:66-17:1. “The user must authorize the transaction by using” or “triggering” “control device 114.” *Id.*, 16:26-27, 17:1-2. If “control device 114 is triggered, it will issue an invariable activation command” and transmit user data, such as “a credit card number . . . or any other user data[,]” to either (1) a merchant data exchange device 104 or (2) a remote data exchange device 108, 109, 110. *Id.*, 16:28-42, 17:10-14. Portable electronic device 102 decides whether to send this financial data to a merchant data exchange device or a remote

data exchange device based on the state of the switching element. For example, device 103 can receive an “activation cue” from merchant data device 104, which causes the switching element to be “assigned its first state[.]” *Id.*, 16:30-37. In this state, user data is conveyed “from electronic circuit 116 to first transceiver 120 and then to [merchant] data exchange device 104.” *Id.* Alternatively, if portable electronic device 102 has not received an activation cue, it is “assigned its second state whereby . . . user data [is] transferred from electronic circuit 116 to second transceiver 122 and then to remote data exchange device 108, 109, 110.” *Id.*, 16:47-51, 17:5-14.

44. Put simply, if an activation cue is received from a merchant data exchange device, device 102 communicates with that data exchange device via transceiver 120. If no activation cue is received, the device 102 communicates instead with a remote data exchange device via second transceiver 122.

VII. THE PROSECUTION HISTORY OF THE '294 PATENT

45. I have reviewed the prosecution history for the '294 Patent (Ex. 1003). Pertinent aspects of the prosecution history of the '294 Patent are described below.

A. The '294 Patent's Priority Claim

46. The '294 Patent issued from U.S. Application Serial No. 12/603,085 (the “'085 *Application*”), filed on October 21, 2009. The '085 Application was a continuation-in-part of U.S App. No. 10/552,912 (the “'912 *Application*”), which

was a U.S. national stage application of PCT/IB2003/001523 filed on April 14, 2003.

In my opinion, the '912 Application does not provide written description support for the Challenged Claims. Accordingly, I understand that the Challenged Claims may not claim priority to this earlier filing.

47. My opinion relies on a combination of *Suga* and *Gorsuch*. Both references are prior art to the '294 Patent even if it were entitled priority to the earlier April 14, 2003 filing. Accordingly, the Proposed Ground does not rise or fall with the outcome of this priority analysis. However, as I briefly covered above, the subject technology—choosing whether to use a first or second transceiver for data transmissions—was well developed by 2009, including commercially available cellular telephones equipped with both WiFi and cellular transceivers. Accordingly, applying October 21, 2009 as the proper priority date for the claims of the '294 Patent allows me to paint a complete picture of the state of the art as of the alleged invention.

48. I have been informed that the Patent Owner “is not presumed to be entitled to the earlier filing dates of ancestral applications which do not share the same disclosure.” *MaxLite, Inc. v. Jiaxing Super Lighting Elec. Appliance Co., Ltd.*, IPR2020-00208, Paper 14 (PTAB June 1, 2021). I understand that, when challenging a priority claim, the Petitioner is obligated to raise the issue “by ‘identifying, specifically, the features, claims, and ancestral applications allegedly lacking written

description support for the claims based on the identified features.” *Id.* (quoting *Lupin*, IPR2015-01775, Paper 15 at 11 (citing *Focal Therapeutics*, IPR2014-00116, Paper 8 at 10)). As I set forth below, there is no support in the pre-2009 applications for conveying data via one of two distinct data transceivers. Because this concept was introduced for the first time in the October 21, 2009 application, the Challenged Claims are not entitled to claim priority date before this date.

49. Each of the Challenged Claims require *two* distinct *data transceivers* for conveying data to external devices using *different communication links*. See, e.g., Ex. 1001, Claim 1 (reciting a “*first data transceiver for sending data*”¹ from said electronic circuit to the first external data exchange device *over* said *first communication link*” and a “*second data transceiver for sending data* from said electronic circuit to the second external data exchange device *over said second communication link*”), Claim 10 (reciting a “*first data transceiver* being operable *for data exchange over a first communication link*” and a “*second data transceiver* being operable *for data exchange over a second communication link* that is distinct from said first communication link”).

50. The ’912 Application does not provide written description for this two-transceiver arrangement. Rather than choosing between distinct data transceivers for

¹ All emphases added unless noted otherwise.

conveying data with different external entities, the '912 Application describes a portable electronic device that either (1) exchanges data with an external device via a single transceiver or (2) conveys data to the user via a user interface (e.g., a display). Ex. 1002 (*'912 Application*),² 2:21-27, 3:31-4:5, 9:24-10:20, 12:20-26. It does not disclose, discuss, or even suggest multiple distinct transceivers for conveying data to different external devices via different communication links.

51. Fig. 4 and its corresponding description—including in the 2009 '085 Application—provide the earliest support for the Challenged Claims' two-transceiver arrangement. As illustrated below, a **first transceiver 120** and **second transceiver 122** are used to communicate with different devices via different communication links:

² All citations to the '912 Application refer to the native page and line numbers.

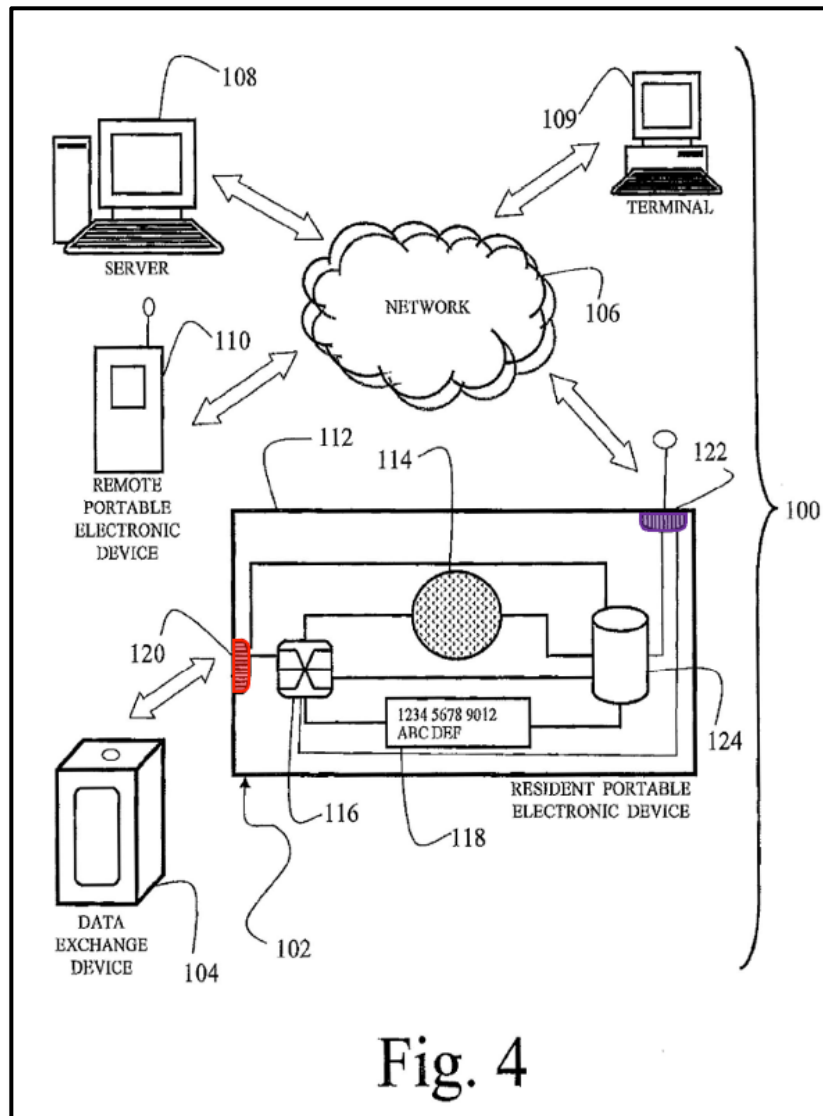
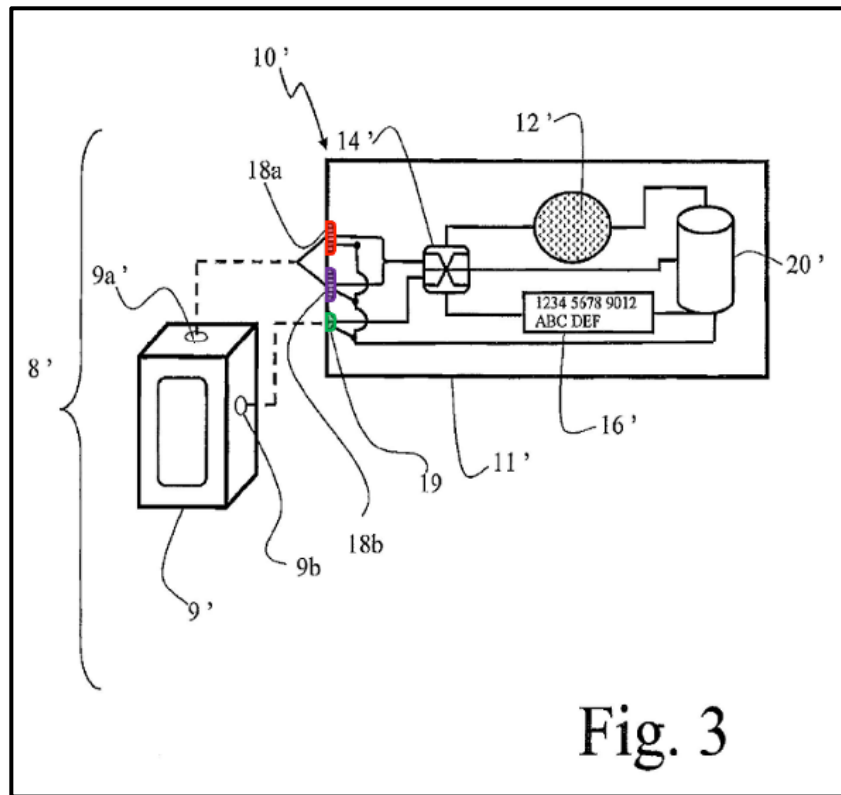


Fig. 4

Ex. 1001, Fig. 4 (annotated).

52. The 2003 '912 Application includes no similar disclosure. There, as illustrated in Fig. 3, only a single transceiver for establishing a single communication link is disclosed to communicate data to an external device. Namely, **data transmitter 18a** is used to transmit data, **data receiver 18b** receives data, and **cue receiver 19** receives the activation cue from the external device:



Ex. 1001, Fig. 3 (annotated). A POSITA would have understood that Fig. 3's data transmitter 18a and data receiver 18b form a single "transceiver" that can communicate over a single communication link to an external device. A transceiver must be able to both send and receive data over a communication link. Indeed, the term transceiver merges the terms *transmitter* and *receiver*, implying the ability to perform both functionalities. Accordingly, a component that is capable of only transmitting or receiving data signals is not a transceiver. A POSITA would also have understood that cue receiver 19 does not send data at all. A receiver differs from a transceiver by not having transmission capabilities, and therefore a cue receiver would not send data. Further, there is no mention of a second external device

or second communication link with a second external device. Accordingly, a POSITA would have understood that Fig. 3 and its corresponding description fail to provide written description support for the Challenged Claims' two-transceiver arrangement.

53. Because the '912 Application does not provide written description support for a second data transceiver for exchanging data over a second communication link, I apply October 21, 2009 as the priority date for the '294 Patent. However, as noted above, both *Suga* and *Gorsuch* are prior art even if the original April 14, 2003 filing date is applied. Although the state of the art did advance between 2003 and 2009, including the introduction of dual-transceiver commercial cell phones, my ultimate conclusions regarding obviousness and motivations to combine the references would not change if assessed in 2003. A POSITA would have been motivated to make the proposed combination and would have expected success in 2003 as well as in 2009.

B. Prosecution History of the '294 Patent

54. A Non-Final Office Action issued on June 6, 2014 rejecting all claims as anticipated or obvious. Ex. 1003 ('294 File History"),³ 65-67. The Examiner did not identify any specific prior art reference, but instead asserted that the pending

³ All citations to the '294 File History refer to the branded page numbers.

claims were taught by “conventional laptop computers [that] provid[ed] both wired and wireless network connections.” *Id.*, 65 The Examiner explained that laptops, particularly those using the Microsoft Windows operating system, were known to automatically establish a network connection to a wireless network or physical wired network, depending on availability. *Id.*, 65-66.

55. In response, the applicant amended the preamble of each claim to recite a “cellular phone,” rather than a “portable electronic device.” *Id.*, 48. The applicant also amended each independent claims to specify that the first and second communication links are distinct from one another. *Id.*, 48-49.

56. The Office then issued a notice of allowance, noting the claims “reflect that the device that is subject of the instant invention is a cell phone, among other amendments.” *Id.*, 30.

VIII. SUMMARY OF UNPATENTABILITY

Proposed Ground of Unpatentability	Exhibits
Ground 1: Claims 1-20 are obvious under pre-AIA 35 U.S.C. § 103 over <i>Suga</i> in view of <i>Gorsuch</i> .	Ex. 1005 Ex. 1006

57. Above, I have reproduced the Proposed Ground of Unpatentability from the Petition for ease of reference.

58. As I discuss below, *Suga* teaches a cell phone capable of sending data communications (such as an email) through either a W-LAN or cellular (wireless

phone) network. *Suga*'s cell phone contains components constituting a cellular transceiver and components constituting a W-LAN transceiver, *Suga* Fig. 2, [0029]-[0041]. *Suga* further teaches that the cell phone attempts to send data communications through W-LAN and, if unsuccessful, sends the data communication through a cellular network, *Id.*, [0043]. However, *Suga* does not expressly describe detecting W-LAN signals to ensure W-LAN is available before attempting a transmission.

59. *Gorsuch* teaches a portable device capable of detecting a W-LAN signal and switching between W-LAN and cellular transceivers *Gorsuch*, 4:12-23. The system uses a W-LAN detection circuit to detect the availability of a W-LAN base station by receiving a beacon frame from the station, *Id.*, 4:31-5:4. By determining the availability of W-LAN, *Gorsuch* teaches automatically transmitting data via the best communication pathway, prioritizing W-LAN when it is available and using cellular when it is not.

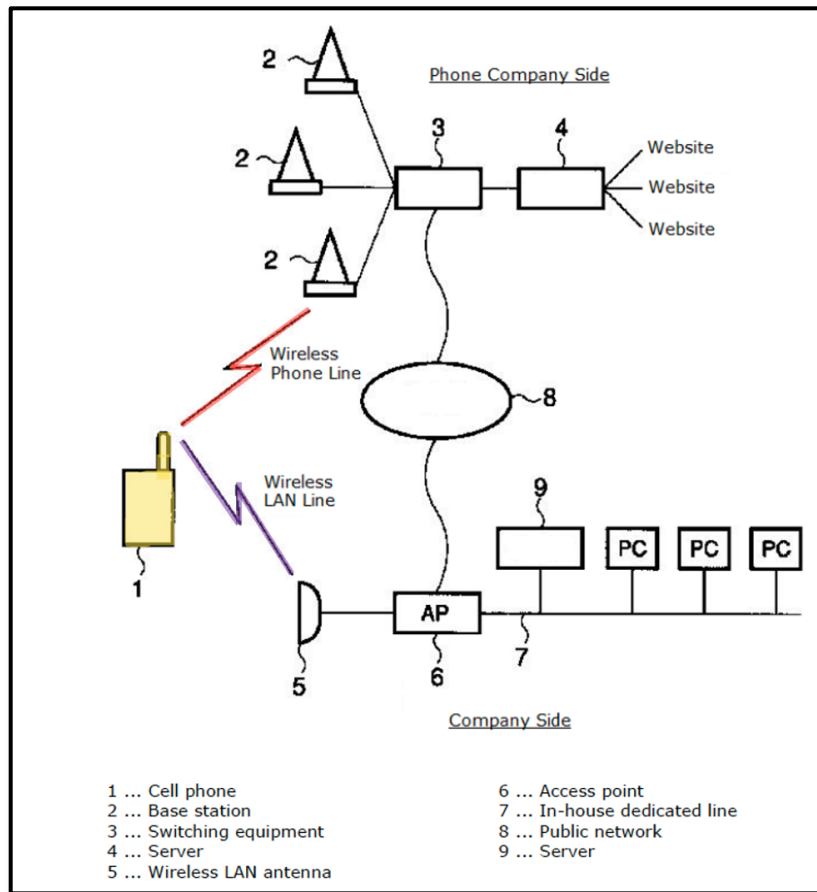
60. The Proposed Combination modifies *Suga* with *Gorsuch*'s W-LAN detection circuit such that *Suga* is able to determine the availability of W-LAN as part of choosing a transceiver for its data transmission.

IX. OVERVIEW OF THE PRIOR ART

A. Overview of *Suga*

61. *Suga* discloses a cell phone 1 equipped with memory (e.g., memory card 35 and SRAM 37), a display (LCD panel 38), keyboard 39, and MPU 40, which “controls the operations of the entire cell phone 1.” *Suga*, [0035]-[0037], [0052], Fig. 2. Cell phone 1 is configured to perform data transmissions through both a wireless telephone connection⁴ (annotated red) and through a wireless LAN connection (annotated purple):

⁴ A POSITA would have understood that the wireless phone line connection discussed in *Suga* is a cellular connection. *See Suga*, [0028]-[0033]. As such, I will use the terms interchangeably in this declaration.



Suga, Fig. 1 (annotated). *Suga* explains that data communications such as email can use either its cellular connection or W-LAN connection:

Based on *cellular mobile communication services* provided by a phone company, the cell phone 1 is able to place calls to other phones via a wireless phone line that connects to a base station 2, *exchange data with websites via an Internet connection service, and exchange data (such as sending and receiving e-mail) with other information devices. The cell phone 1 also exchanges data (such as e-mail) with other devices via a wireless LAN line.*

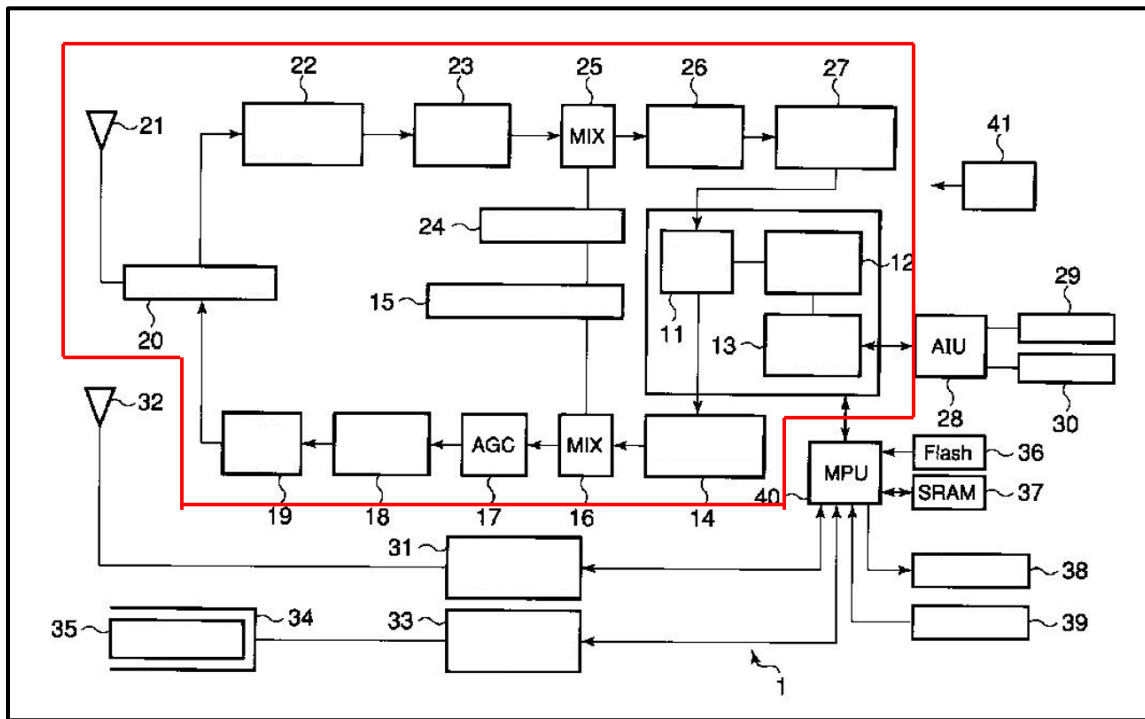
Id., [0016].

62. *Suga* describes separate transceiver hardware for these distinct wireless communication technologies. A Wireless LAN controller 31 allows cell phone 1 to transmit and receive data through a W-LAN connection. *Id.*, [0034]. The cell phone is also equipped with cellular transceiver circuitry:

The cell phone 1 has a modem 11, a channel CODEC unit 12, and a voice CODEC unit 13 as modem functions for phone line connections. The ***modem 11 modulates and demodulates the transmitted and received signals.*** The channel CODEC unit 12 performs coding and decoding of channel signals. The audio CODEC unit 13 performs coding and decoding of audio signals.

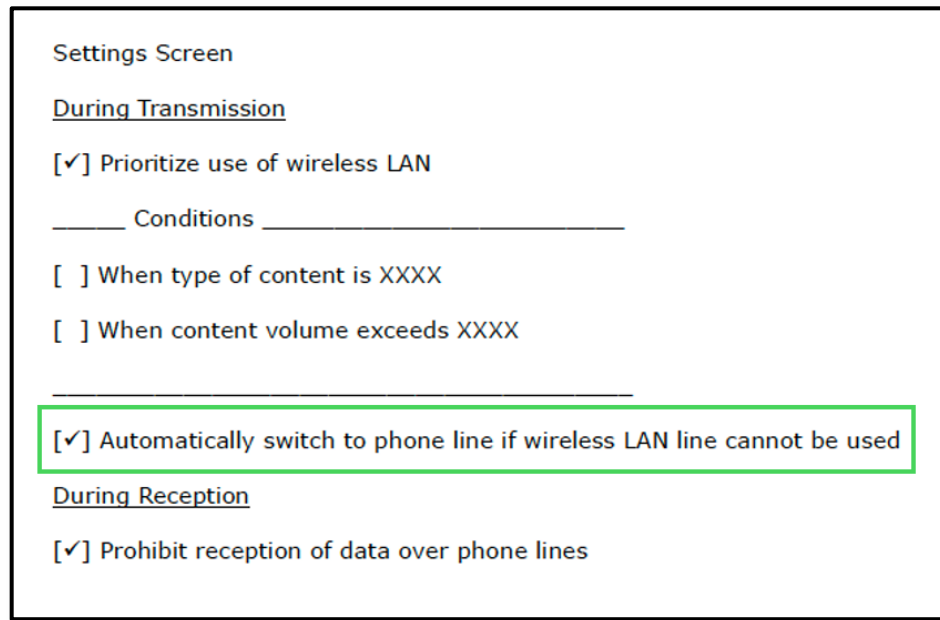
The cell phone 1 also has a quadrature modulator 14, frequency synthesizer 15, mixer 16, AGC unit 17, SAW filter 18, power amplifier 19, duplexer 20, antenna 21, low-noise amplifier 22, SAW filter 23, SAW filter 24, mixer 25, SAW filter 26, and quadrature demodulator 27 ***as signal transmitting and receiving functions for phone line connections.***

Id., [0029]-[0030]. For cellular communications, duplexer 20 “separates transmitted and received signals to and from the antenna” which in turn “exchanges signals with the outside world by means of cell phone radio waves.” *Id.*, [0031]. These cellular transceiver components are shown in the annotated Fig. 1 within the **red boundary**.



Id., Fig. 2 (annotated).

63. A settings screen permits users to dictate how and when cellular and W-LAN transmission is utilized. As shown in Fig. 5, cell phone 1 can be configured to prioritize W-LAN and to automatically switch to a cellular network when a W-LAN connection is unavailable. Additionally, a user can set conditions (e.g., data type and data volume) that cause the phone to attempt W-LAN communication. *Id.*, [0048-0049].

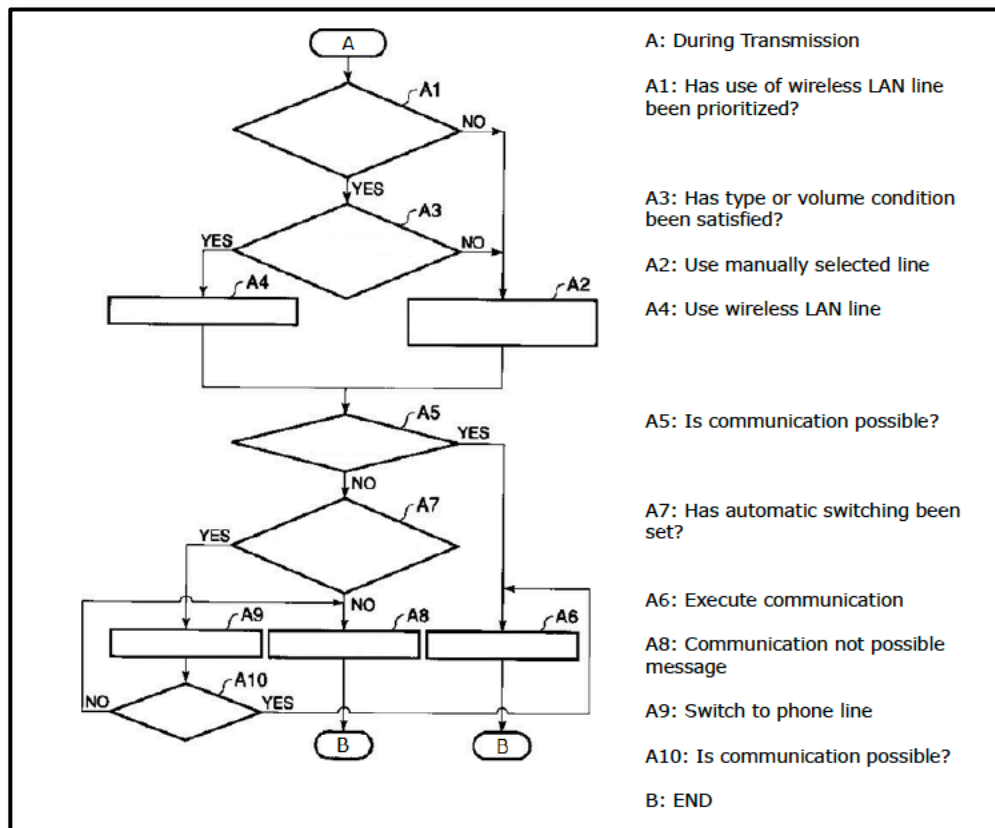


Id., Fig. 5 (annotated).

64. Fig. 6 depicts a flowchart of the complete process conducted by *Suga*'s cell phone 1 when the user attempts to send data (for example, an email) if the phone is set to preferentially use wireless LAN. *Id.*, [0045], [0047]. At step A1, the system confirms that W-LAN should be prioritized. *Id.*, [0047]. At step A3, user set conditions are checked. *Id.*, [0048]. If these conditions are met,⁵ step A4 confirms the W-LAN transceiver will be used for the data transmission. *Id.*, [0049]. Step A5

⁵ *Suga* teaches that the data type and data volume conditions can both be enabled or disabled. *Suga*, [0043]. A POSITA would have understood that disabling both conditions results in a process flow that attempts to use W-LAN for all data transmissions. That is, disabling both condition requirements means there are no data type or data volume conditions and all data transmissions will satisfy step A3.

analyzes whether communication is possible via the selected transceiver. If communication is possible with the W-LAN line, the communication is sent at step A6. *Id.*, [0050]. If communication with the W-LAN line is not possible, step A7 confirms that automatic switching has been set, switches the selected transceiver to cellular at step A9, confirms cellular transmission is possible at step A10, and executes transmission via the cellular connection at step A6. *Id.*, [0050]-[0052].



Id., Fig. 6.

65. Both *Suga* and the '294 Patent are directed to data communications⁶ using electronic devices and are in the same field of endeavor. *Compare Suga*, [0011] (disclosing a cell phone that can transmit data through a wireless telephone line and through wireless LAN, prioritizing use of W-LAN), *with* Ex. 1001, Abstract, 13:47-49 (“Portable electronic device 102 may be for example a cellular phone[.]”), 16:8-10 (“[P]ortable electronic device 102 may be used to accomplish a financial transaction through one of different means as described hereinafter.”). Further, *Suga* is reasonably pertinent to a problem sought to be solved by the '294 patent—automatically managing data communications in a multi-transceiver device. *Compare Suga*, [0045-0052], Fig. 6, *with* Ex. 1001, 17:27-32. Therefore, *Suga* is analogous art to the '294 Patent.

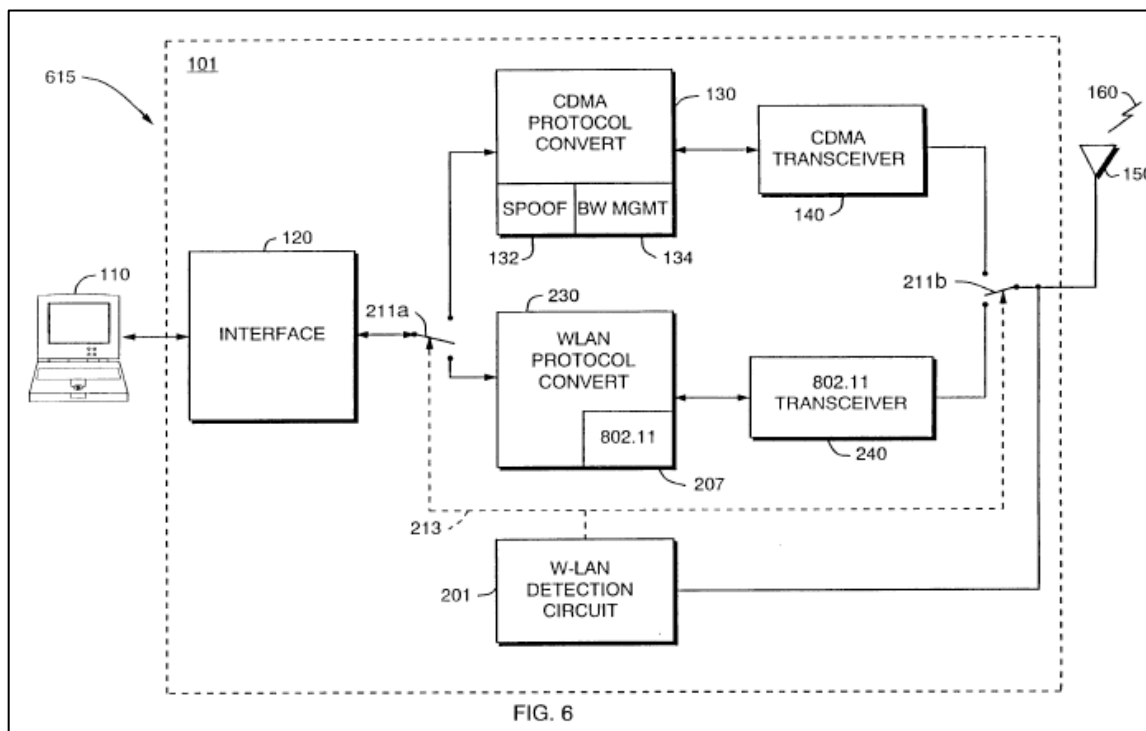
B. Overview of *Gorsuch*

66. *Gorsuch* discloses techniques for switching between a local wireless connection (W-LAN), e.g., WiFi, and a long-range cellular network connection on a mobile device. *Gorsuch*, 3:25-28. Specifically, a mobile device connects directly

⁶ The claims of the '294 Patent are facially agnostic to the type of data communicated. The specification clarifies that the invention is not limited to financial data. Ex. 1001, 16:37-42 (listing different types of data that may be transmitted, including “any other user data including user identification data and/or user financial data”).

to a WLAN when possible/available and automatically reverts to a cellular network (CDMA) when the W-LAN is unavailable (e.g., when out of range of a W-LAN base station). *Id.*, 2:1-30, 3:16-19, 3:25-28.

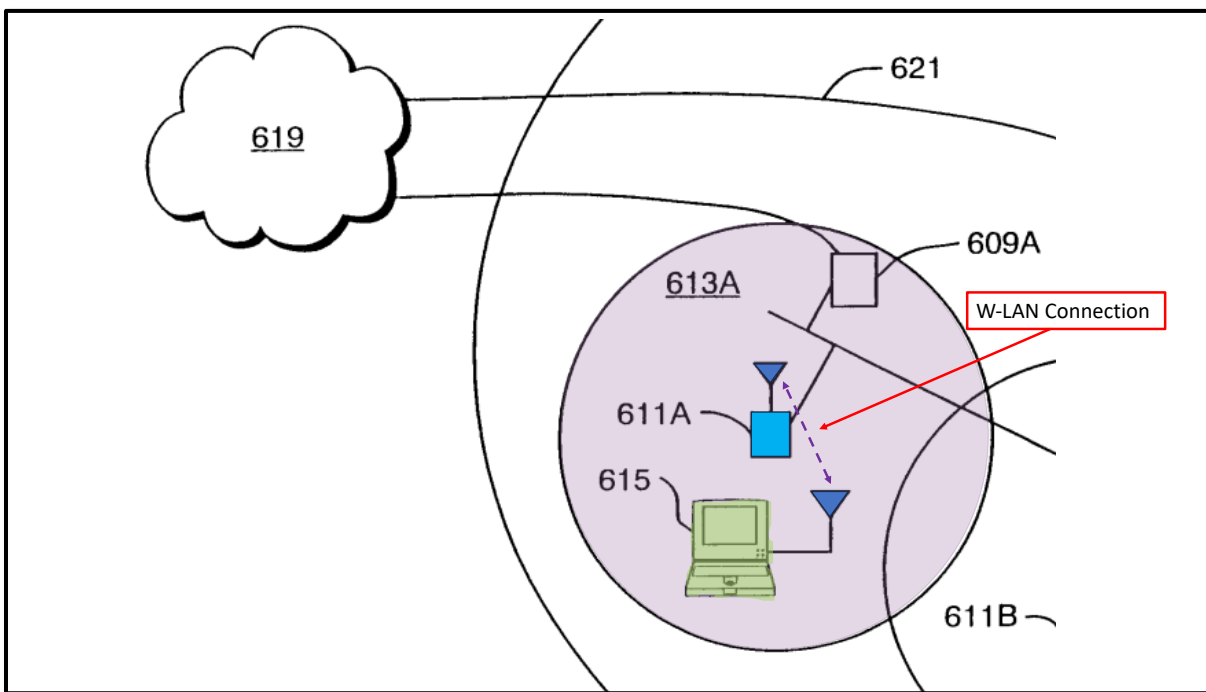
67. In one embodiment, user terminals are a “PDA or other similar device” equipped with “subscriber unit” 101. *Id.*, 14:4-9; *see also id.*, 1:4-8. The subscriber unit 101 includes two transceivers: W-LAN transceiver 240 and CDMA transceiver 140. *Id.*, Fig. 6, 14:4-14. Note also that in Fig. 6 (shown below), the subscriber unit includes a WLAN detection circuit.



Id., Fig. 6.

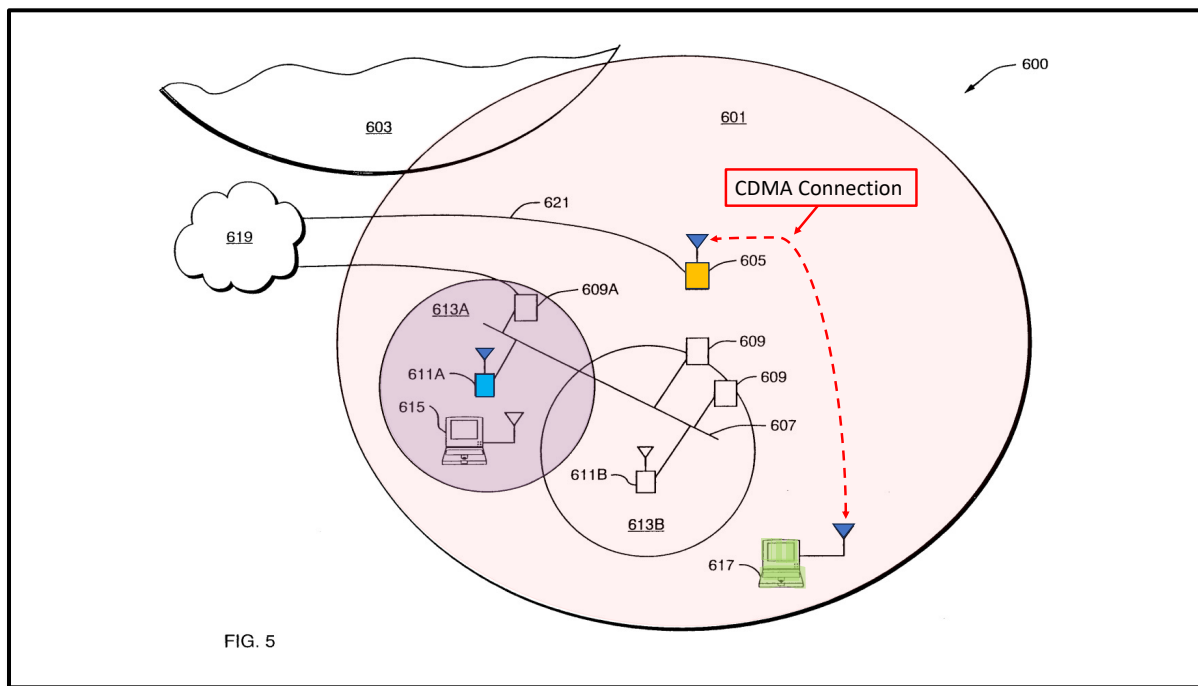
68. W-LAN transceiver 240 (within the subscriber unit of terminal 615, 617) can communicate with W-LAN base station 611A when the transceiver 240 is

within the range 613A of the base station. *Id.*, 4:15-18, 13:1-10, Fig. 5. This communication path over the W-LAN connection is shown in the annotated excerpt of Fig. 5 below.



Id., Fig. 5 (annotated to indicate terminal 615 within range of W-LAN base station 611A).

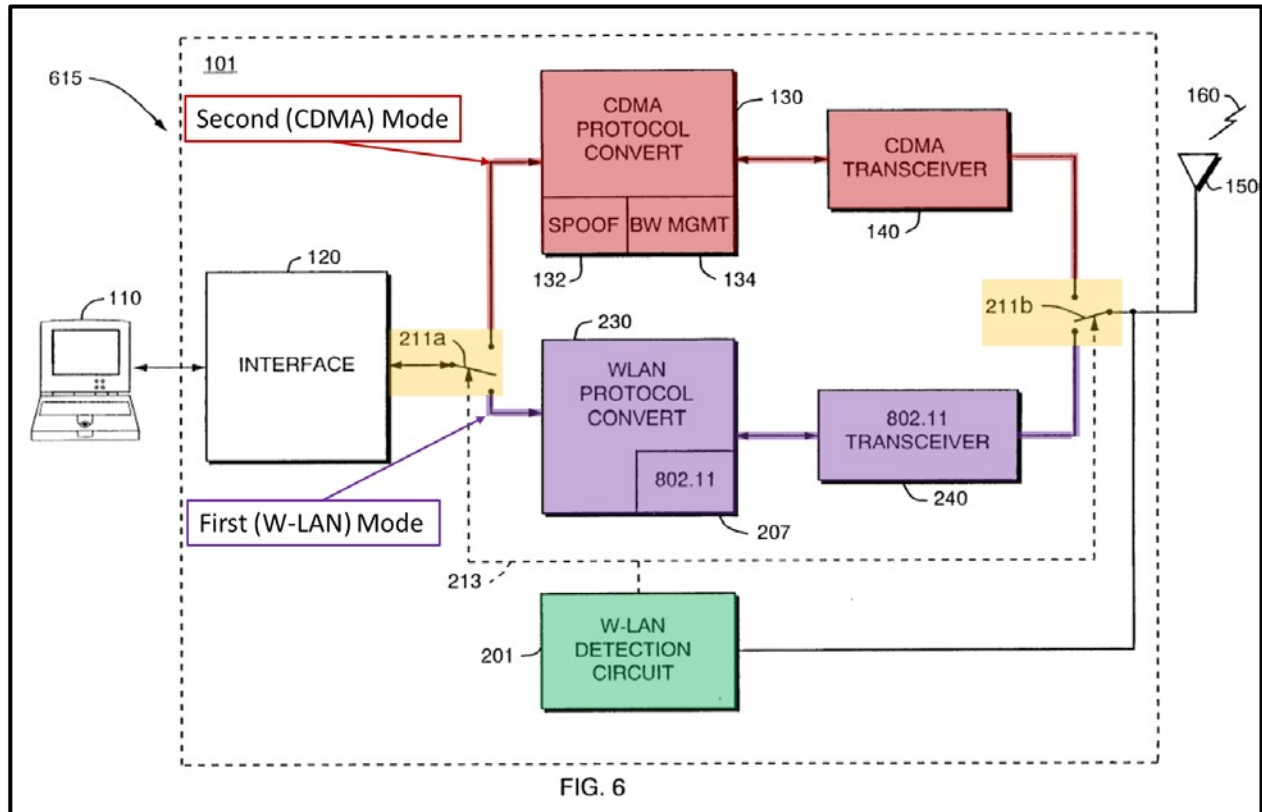
69. When the terminal is not within range of a W-LAN base station, CDMA transceiver 140 (within the subscriber unit of terminal 615, 617) can communicate with a long range base station 605. *Id.*, 4:15-18, 12:18-19, 13:1-5, 13:28-32, Fig. 5. *Gorsuch*'s Fig. 5 illustrates this longer range connection between a terminal 617 and a cellular base station 605:



Id., Fig. 5 (annotated excerpt).

70. To switch between the W-LAN and CDMA transceivers and connections, subscriber unit 101 includes a W-LAN detection circuit 201. *Id.*, Abstract, 4:31-5:1, 13:14-22, 14:10-14, 16:1-12, Fig. 6. “W-LAN detection circuit 201 detects the presence or availability of a W-LAN base station 611[,]” by receiving a beacon frame from a W-LAN base station. *Id.*, 16:1-5; *see also id.*, Abstract, 4:31-5:1, 13:14-22, 14:10-14. If W-LAN detection circuit 201 receives a beacon frame, switches 211A and 211B are switched to utilize W-LAN communications. *Id.*, Abstract, 16:6-8, Fig. 6. But if no beacon frame is received, these same switches instead allow for cellular communications. *Id.*, Abstract, 16:3-5, Fig. 6. These two modes of operation are illustrated in annotated Fig. 6 below where the cellular

(CDMA) transceiver circuit is highlighted in red, the WLAN transceiver circuit is highlighted in purple and the WLAN detection circuit is highlighted in green.



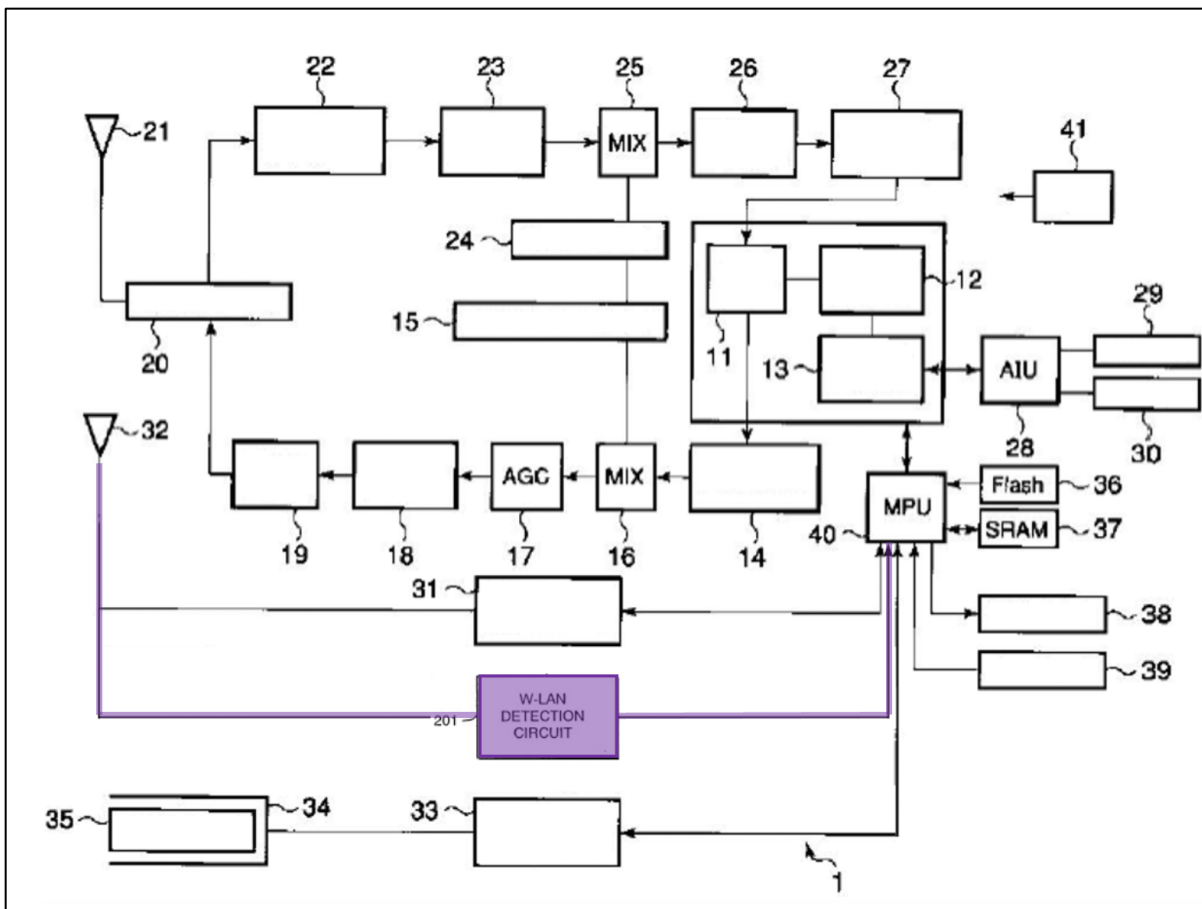
Id., Fig. 6 (annotated excerpt).

71. Both *Gorsuch* and the '294 Patent are directed to data communications using electronic devices and are in the same field of endeavor. *Compare Gorsuch*, Abstract, *with* Ex. 1001, Abstract. Further, *Gorsuch* is reasonably pertinent to a problem sought to be solved by the '294 patent—automatically managing data communications in a multi-transceiver device. *Compare Gorsuch*, Abstract, 3:29-4:4, *with* Ex. 1001, 17:27-32. Therefore, *Gorsuch* is analogous art to the '294 patent.

C. Combining *Suga* and *Gorsuch*

72. As set forth above, both *Suga* and *Gorsuch* teach portable devices that automatically switch between W-LAN and cellular transceivers, prioritizing W-LAN when available. Although *Suga* details the process through which its cellular phone chooses which transceiver to use for a given data communication, including by utilizing W-LAN when “possible,” it does not describe in detail the process through which its phone determines whether W-LAN communications are in fact possible. *Gorsuch*, however, teaches a subscriber unit 101 equipped with a W-LAN detection circuit that is specifically intended to detect W-LAN availability and to switch between W-LAN and cellular transceivers based on this detection. The Ground below establishes that a POSITA would have been motivated to implement *Gorsuch*’s W-LAN detection circuit into *Suga*’s cellular phone, providing a means to determine when W-LAN communications are possible.

73. As illustrated below, the proposed modification incorporates *Gorsuch*’s W-LAN detection circuit 201 into *Suga*’s cell phone architecture. In this arrangement, the MPU 40 uses information from the W-LAN detection circuit to determine whether W-LAN data transmissions are “possible,” allowing the MPU 40 to route data, such as an email, through the appropriate transmission pathway.



Suga, Fig. 2 (annotated to show *Gorsuch*'s W-LAN detection circuit in purple).

D. Motivation to Combine *Suga* and *Gorsuch*

74. For a number of reasons, a POSITA would have been motivated to combine *Suga* and *Gorsuch* as proposed. First, a POSITA would have understood *Suga*'s cellular phone requires the ability to detect when W-LAN communications are "possible," would have understood that *Suga* does not describe any specific means for detecting W-LAN availability and would have looked to known solutions in the art for detecting W-LAN availability. *Gorsuch* includes a starkly similar disclosure to *Suga*, making its solution an intuitive one to incorporate into *Suga*'s

cellular phone. Indeed, both *Suga* and *Gorsuch* teach dual-transceiver equipped mobile devices that automatically choose a prioritized network based on availability. Each reference describes a portable device equipped with the same type of dual-transceiver hardware and network switching functionality—a cellular transceiver and W-LAN transceiver coupled with the ability to choose either transceiver for a given data communication. *Suga*, Abstract, [0010]; *Gorsuch*, Abstract, 16:1-12. Given their similar structures and functionalities, a POSITA would have found *Gorsuch*'s W-LAN detection circuit an obvious choice to integrate into *Suga*'s cellular phone.

75. Second, a POSITA would recognize that implementing *Gorsuch*'s W-LAN detection circuit in *Suga*'s cell phone would improve *Suga*'s similar device in the same way it benefits *Gorsuch*. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (“[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious[.]”). *Suga* teaches that cell phone 1 sends data through the W-LAN if possible, reverting to a cellular connection when W-LAN is unavailable:

Communication is attempted [through W-LAN], and it is determined whether communication is possible (step A5). ***If communication is possible, communication is performed*** (step A6) and the process is terminated. If communication ***is not possible***, it is determined whether

or not the “Automatically switch to phone line if wireless LAN line cannot be used” setting is enabled (step A7).

Suga, [0050]. A POSITA would understand that determining whether W-LAN communication is possible requires some ability to assess the availability of the W-LAN communication channel. This *could* be accomplished via brute force, attempting to transmit the actual data payload and then assessing whether the transmission was successful. However, a POSITA would recognize that a more efficient means of accomplishing this step in *Suga*’s process is for the cellular phone to assess the W-LAN connection to determine its availability (e.g., the presence or availability of the W-LAN connection) without attempting to transmit the full data payload. *Gorsuch* teaches a beacon-based method for detecting the availability of a W-LAN connection that does not require attempting to transmit a full data payload. Namely, *Gorsuch*’s W-LAN detection circuit can detect the presence of a “beacon frame” transmitted periodically on the W-LAN network. *Gorsuch*, 13:14-22, 16:1-3 (noting the W-LAN detection circuit “detects the presence or availability of a W-LAN base station [] using . . . one of the techniques previously discussed”); A POSITA would understand that *Gorsuch*’s W-LAN detection circuit uses a beacon-based method to detect W-LAN availability. *Gorsuch* suggests that the detection can be either passive (e.g., awaiting a beacon signal) or active (e.g., transmitting a probe request and detecting a response). *Id.*, 4:31-5:4. *Gorsuch* specifies that in

embodiments where passive scanning is used, an IEEE 802.11 compliant W-LAN hub is used, which transmits a beacon frame at regular intervals. *Id.*, 13:14-18. *Gorsuch's* device detects a beacon frame by waiting a period of time equal to the beacon interval. *Id.*, 13:18-22. Using active and passive scanning to detect a beacon frame was already a common way of determining W-LAN availability. *See* Ex. 1011, 39-40. This beacon method of detecting the availability of W-LAN benefits *Gorsuch's* system by allowing *Gorsuch's* device to efficiently determine whether W-LAN should be selected for data transmission without having to attempt the actual data transmission and monitor for success or failure. Receiving a beacon frame informs the device that W-LAN is available for wireless communication, improving the likelihood that a data communication can be completed over the network. A POSITA would understand the same efficiencies would benefit *Suga* in the same way, allowing *Suga's* cellular phone to determine whether W-LAN communications are "possible" without attempting to actually transmit the full data payload over the W-LAN network.

76. Finally, a POSITA would have expected success in making the proposed modification. Given the stark similarities between these references, as discussed above, integrating *Gorsuch's* W-LAN detection circuit in *Suga's* cellular phone would have been straightforward and well within the capabilities of a POSITA. As discussed above, a number of cellular phones at the time included both

cellular and W-LAN (Wi-Fi) connectivity. Further, a POSITA would understand how to physically connect the W-LAN detection circuit to the MPU and would understand how to program the MPU to use the information provided by the W-LAN detection circuit. Further, the benefits of automatically detecting network availability and choosing the optimal available network was widely recognized and implemented in the art. For example, as I discuss in Section V.B of this declaration, the commercial Nokia 6136 cellular phone included a “seamless handoff of mobile voice and data from a wide area cellular network to WLAN or Wireless Fidelity (Wi-Fi), so it is possible to connect at a high speed to the internet from virtually anywhere.” Ex. 1009, pg. 59. As discussed above, a number of other phones had multiple radios that facilitated connections to cellular and Wi-Fi, including the T-Mobile G1, the Sony Ericsson Xperia 1, the Blackberry Bold, the Apple iPhone 3G and the HTC Touch Pro. Ex. 1012. Similarly, U.S. Patent No. 8,165,559 to Klesper et al. (“*Klesper*”) (Ex. 1008) discloses a combo phone that is capable of connecting to an open access point, for example WiFi or WiMax, or to a cellular network access point to make a call to emergency services. *Klesper*, 8:8-14, Fig. 6. Further, Klesper states that “combo phones, as well as other types of call systems, are well known in the art.” *Klesper*, 5:52-54. Finally, U.S. Patent No. 8,792,454 to Taniuchi et al. (“*Taniuchi*”) (Ex. 1007) teaches a system for seamless roaming between multiple networks for a mobile node. *Taniuchi*, (57), 2:22-24, 1:21-27, Fig. 4. Taniuchi

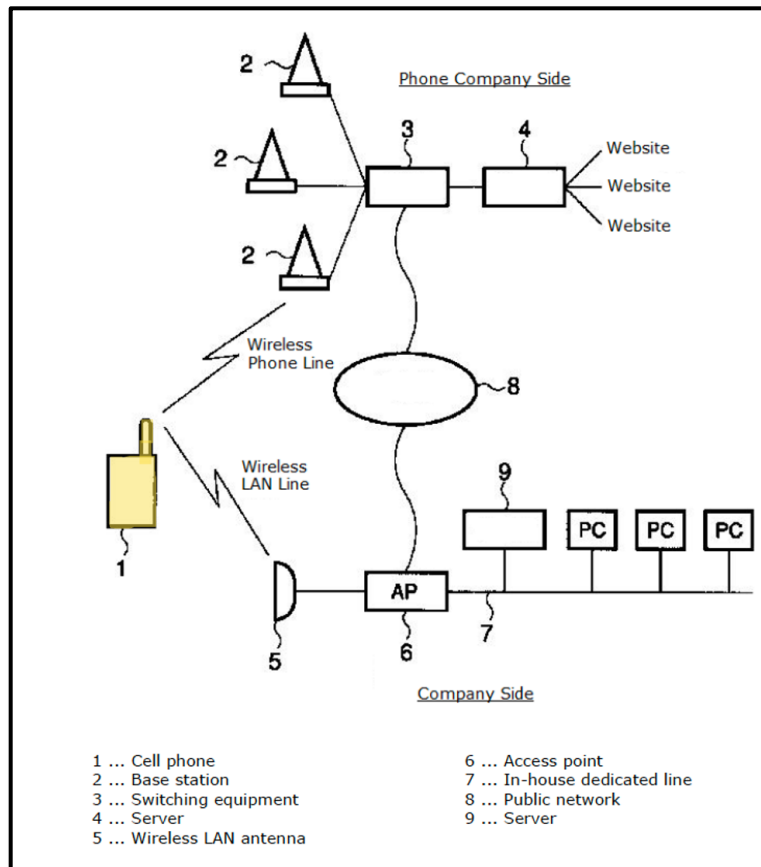
teaches transitioning from a WLAN to a cellular network when the signal strength of the WLAN drops below a predetermined threshold. *Taniuchi*, 16:29-41. As a final example, the Nokia N93 included cellular (voice and data), W-LAN and BlueTooth radios. Ex. 1016, 90-93. Given the prevalence of dual-mode cellular devices, including cellular phones, a POSITA would have had an expectation of success when implementing *Gorsuch*'s W-LAN detection circuit in *Suga*'s cellular phone.

X. GROUND 1: OPINIONS REGARDING *SUGA* AND *GORSUCH*

A. Claim 1

[1(Pre)] A cellular phone, comprising:

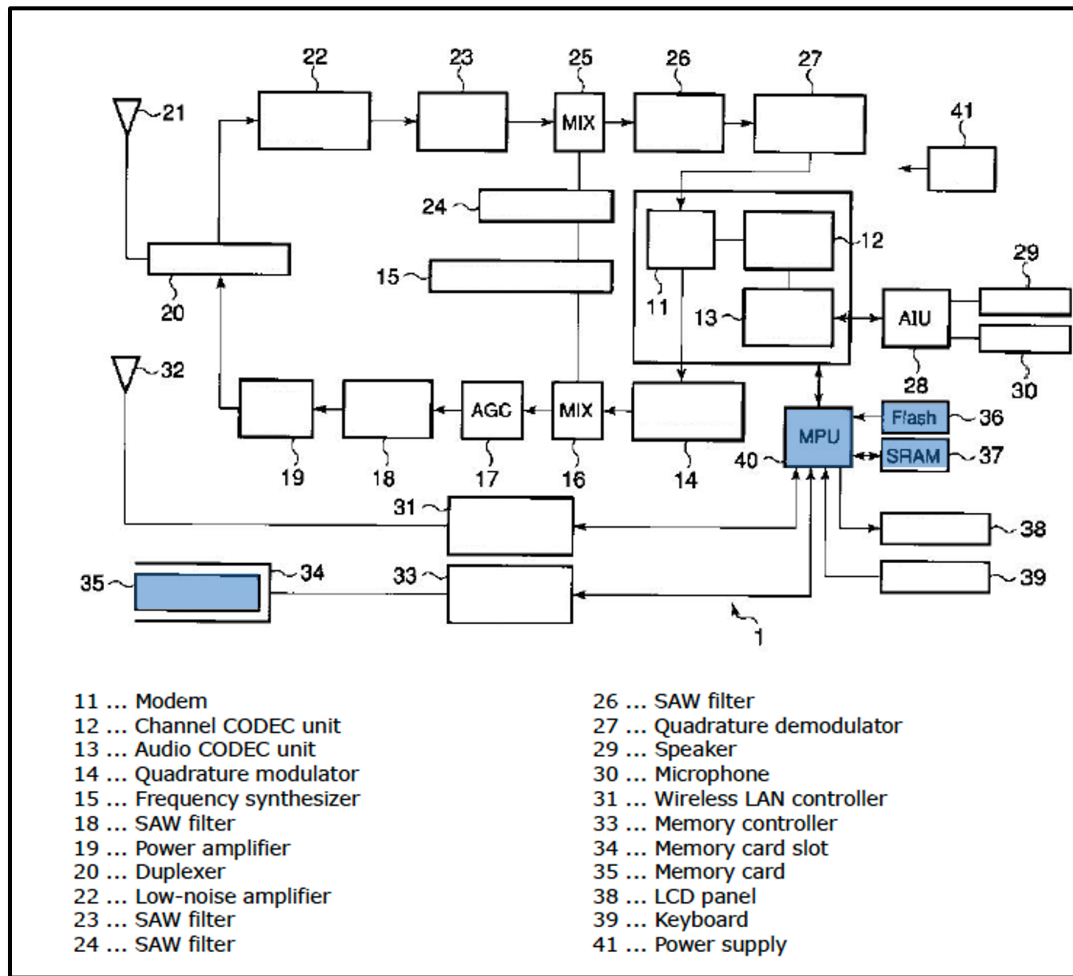
77. To the extent the preamble is limiting, *Suga* teaches it. For instance, *Suga* discloses “cell phone” 1 that can “exchange data with websites via an Internet connection service, and exchange data (such as sending and receiving email) with other information devices.” *Suga*, [0016], Fig. 1.



Id., Fig. 1 (annotated).

[1(a)] an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output;

78. *Suga* discloses this limitation. For example, *Suga* discloses that the cell phone includes, among other parts, MPU 40, a memory card 35, flash memory 36, and SRAM 37 that comprise an electronic circuit. *Suga*, [0035]-[0037]. A power supply 41 supplies power to the components of the cell phone 1, including the electronic circuit, as shown in Fig. 2 (electronic circuit in blue).



Id., Fig. 2 (annotated).

79. *Suga* further discloses the MPU 40 “controls the entire operation of the cellular phone 1[,]” including performing switching control between the cellular and W-LAN connections, and sending/receiving data “such as an e-mail” through either network. *Suga*, [0037], [0045]-[0047], [0053]. Therefore, a POSITA would understand that the MPU 40 “is capable of processing data[,]” “data [output,]” and “data input[.]” The memory card 35 “is used to store content handled by the cell phone 1” such as “e-mails, audio information, and video information.” *Suga*, [0035].

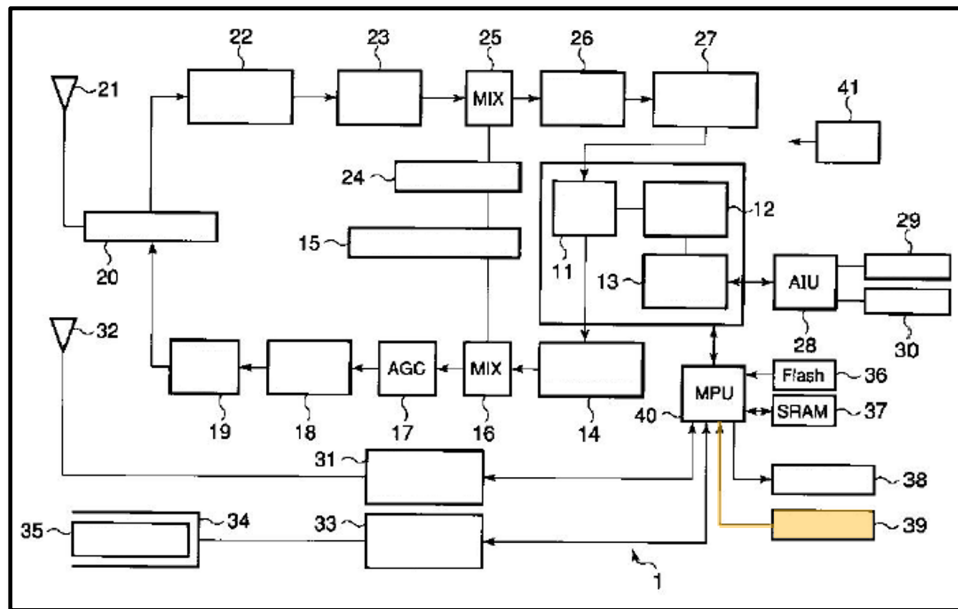
Flash memory 36 “is a memory built into the cell phone 1 and is used to store various types of data” and SRAM 37 “is a memory that provides a work area for the MPU 40.” *Id.*, [0036]. A POSITA would understand that a circuit including at least the MPU 40, memory card 35, flash memory 36, and SRAM 37 is “capable of storing data therein, capable of processing data, and capable of data input and output” to send and receive e-mails—functionality expressly ascribed to *Suga*’s cellular phone.

[1(b)] a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, with said invariable activation command being issued when said control device is selectively triggered by the user;

80. *Suga* discloses this element. For example, *Suga* discloses keyboard 39 (“a user-triggered control device”) that a user engages (i.e., “selectively trigger[s]”) to initiate the process of sending an email. In response to the user triggering an email, *Suga*’s device causes the email to be transmitted either via a cellular connection or W-LAN connection, depending on the availability of W-LAN. As discussed below, because the choice between wireless networks is based on the availability of W-LAN and cannot be influenced by the user (at the time of transmission), the device’s command to transmit an email (“activation command”) is “invariable[,]” as claimed.

Suga’s “user-triggered control device operatively linked to said electronic circuit . . . configured to be operated by a user via . . . a button”

81. *Suga* is silent in describing the process for a user to initiate sending an email. However, a POSITA would have understood that to send an email, a user would trigger the device by pressing one or more buttons on the keyboard 39 to initiate the transmission. Ex. 1010, Abstract, [0002]-[0003], Figs. 1, 4, and 5. This decision is processed by the MPU 40 in order to send the email. *Suga*, [0045]-[0047]. A POSITA would understand that inputs such as buttons on a keyboard send electronic signals that are interpreted by a processor in a cell phone, such as the MPU of *Suga*. Ex. 1010, [0020]-[0021]. For example, depending on the state of the device (the options selected by a user), a “send” key can send an email, send a text, or dial a phone number. The MPU, as the processor that controls the functions of the device, is responsible for interpreting the key press and implementing the proper function. Ex. 1010, [0020]. *Suga*, [0037]. As shown in Fig. 2, keyboard 39 is connected to the MPU 40 and, therefore, is “operatively linked to said electronic circuit.”



Id., Fig. 2 (annotated).

Suga’s “invariable activation command [is] issued when said control device is selectively triggered by the user”

82. After a user triggers sending an email by pressing a key on keyboard 39, *Suga’s* device generates an “invariable activation command,” as claimed. Namely, *Suga’s* device transmits an email either via W-LAN or cellular based on W-LAN’s availability, providing the user no option to *vary* which connection is used for a given transmission. Once the user engages the keyboard 39 (e.g. presses a “send” button”) to authorize sending an email, the email will be sent through one of two data conveyance operations—either via W-LAN or cellular—and the choice of data path is outside the user’s control. Specifically, MPU 40 follows programming based on the user’s preselected options to determine through which communication pathway the data should be sent.

83. The user's "trigger"—pressing a button to send an email—causes *Suga's* electronic circuit to generate the activation command. Specifically, a POSITA would have understood that the MPU 40 in *Suga* interprets the user's key press and then causes the device to convey an email to another party. A POSITA would have understood that a user engaging the keyboard generates an electrical signal/impulse that is interpreted by the MPU. Because the electrical signal/impulse causes a data conveyance, the signal from the keyboard to the MPU is an activation command, as claimed. Alternatively, because the MPU interprets the keyboard's electrical signal/impulse to further the data conveyance, the collective operation performed by the keyboard and MPU issues an activation command, as claimed. The key press sends an electronic signal to the MPU. In a system such as a cell phone, it is understood that a single key can have multiple uses depending on the state of the device. A processor (the MPU) must interpret the keystroke and perform the correct process. In *Suga*, it is clear that a key press from a user would be required to send an email, and the MPU would interpret the key press to initiate the data conveyance. In my opinion, both of these processes, the electronic signal sent from the keypad to the MPU and the interpretation of the electronic signal by the MPU, meet the definition of an invariable activation command. They both cause a data conveyance to be initiated through a path chosen without active user input.

84. Although *Suga*'s device does allow a user to set general preferences regarding when W-LAN and cellular connections are used, there is no ability for a user to "vary" an individual data transmission. That is, when a user triggers an email to be sent, the device selects a network pursuant to an algorithm that is influenced by the user settings, but does not provide the user any ability to vary which network is used. In this way, the email transmission is "invariable[.]" as claimed. The transmission method is determined by a predetermined set of rules and not by active user choice at the time the control device is triggered. In more detail, a user may choose to prioritize W-LAN when available by setting "Prioritize use of wireless LAN" and "Automatically switch to phone line if wireless LAN line cannot be used[.]" *Suga*, [0043], [0047]-[0052], Fig. 5. After these options have been selected, a subsequent request to send an email will cause the cell phone to send the email through the W-LAN when "possible[.]" If W-LAN "communication is not possible . . . the controller switches to a phone line and attempts to communicate with the counterparty". *Suga*, [0047], [0050]-[0051], Fig. 6. Accordingly, when a user triggers the device by pressing a key on the keypad to send an email, *Suga*'s MPU 40 interprets the user input and causes an email to be sent via one of two transceiver paths where the choice of transceiver is invariably made by the device. *Id.* That is, the device selects one of two transceivers for the data transmission without providing the user an option to dictate or change the transceiver choice in real time. *Suga*

describes this process in detail, outlining how the cell phone first attempts to send the data through W-LAN and, if that is not possible, through cellular. The user does not receive any choice in the data pathway after triggering the control device to send the email.

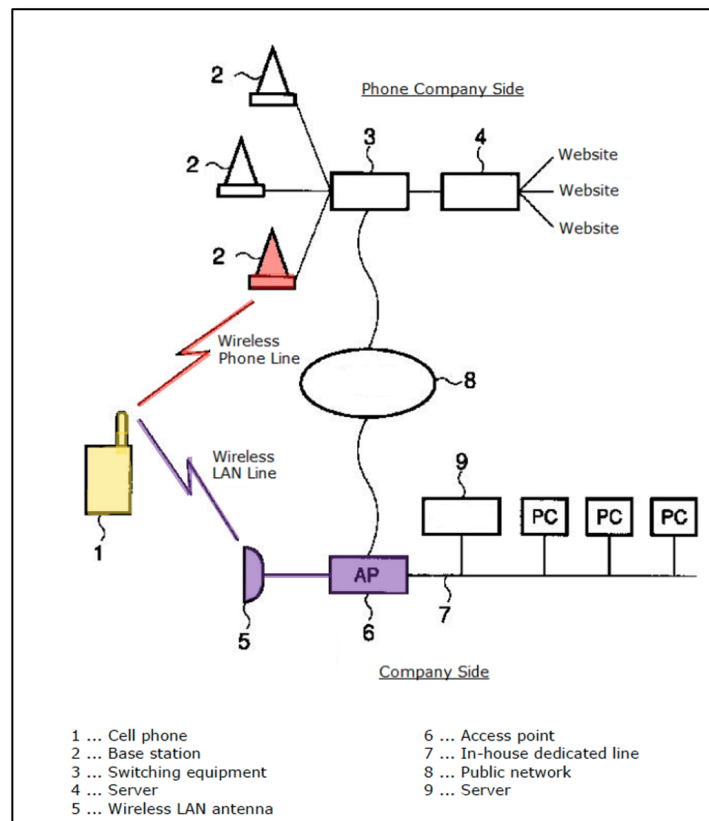
85. In sum, by pressing one or more buttons on the keyboard 39, a signal is sent to the MPU 40 in *Suga* that is an “invariable activation command” or alternatively causes one to be generated by the MPU. This command activates an email conveyance that causes the device to send an email through one of the two data paths without further user-intervention. *See* Section III.D.

[1(c)] a first data transceiver operatively linked to said electronic circuit, said first data transceiver being for exchanging data between said electronic circuit and a first external data exchange device over a first communication link;

[1(d)] a second data transceiver operatively linked to said electronic circuit, said second data transceiver being for exchanging data between said electronic circuit and a second external data exchange device over a second communication link that is distinct from said first communication link;

86. *Suga* teaches this limitation. *Suga* discloses a cell phone 1 that transmits data through either a W-LAN network (using a first data transceiver over a first communication link connected to a first external data exchange device) or a cellular network (using a second data transceiver over a second, distinct communication link connected to a second external data exchange device). *Suga*, [0057], Fig. 1. Specifically, Fig. 1 discloses a cell phone 1 connecting to both a W-LAN access point 6 (“first external data exchange device”) via wireless LAN antenna 5 over a

W-LAN line (“first communication link”) shown in purple, and a base station 2 (“second external data exchange device”) over a wireless phone line (“second communication link”) shown in red.



Suga, Fig. 1 (annotated).

Suga’s W-LAN transceiver and cellular transceiver are linked to the phone’s “electronic circuit”

87. Cell phone 1 includes an electronic circuit, comprising MPU 40, which “controls the operations of the entire cellular phone 1,” including performing switching controls between the cellular and W-LAN connections, and sending e-mail through either network. *See* Claim [1(a)]. Connected to this electronic circuit,

W-LAN controller 31 (“a first data transceiver”) is used to transmit data over W-LAN and a cellular modem (“a second data transceiver”) is used to transmit and receive data via the cellular network.

88. This infrastructure allows *Suga* to perform data communications such as email using either a cellular connection or a W-LAN connection:

Based on *cellular mobile communication services* provided by a phone company, the cell phone 1 is able to place calls to other phones via a wireless phone line that connects to a base station 2, exchange data with websites via an Internet connection service, and *exchange data (such as sending and receiving e-mail) with other information devices. The cell phone 1 also exchanges data (such as e-mail) with other devices via a wireless LAN line.*

Id., [0016]. Because *Suga*’s MPU 40—part of the claimed “electronic circuit”—is responsible for causing an email to be sent via either transceiver, both transceivers are linked to the electronic circuit, as claimed. A POSITA would understand that the MPU sends the data to be transmitted to the proper transceiver in the form of electronic signals. As such, each transceiver is linked to the MPU.

Suga’s Wireless LAN Controller 31 is a “First Transceiver”

89. *Suga* describes separate transceiver hardware for these distinct wireless communication technologies. A Wireless LAN controller 31 allows cell phone 1 to transmit and receive data through a W-LAN connection via antenna 32. *Id.*, [0034], Fig. 2. The Wireless LAN controller 31 and antenna 32 connected to the MPU 40

(“operatively connected to said electronic circuit”). These components are shown in the annotated Fig. 2 in green. The W-LAN controller 31 allows data communication to the access point 6 through a W-LAN line. *See id.*, Fig. 1.

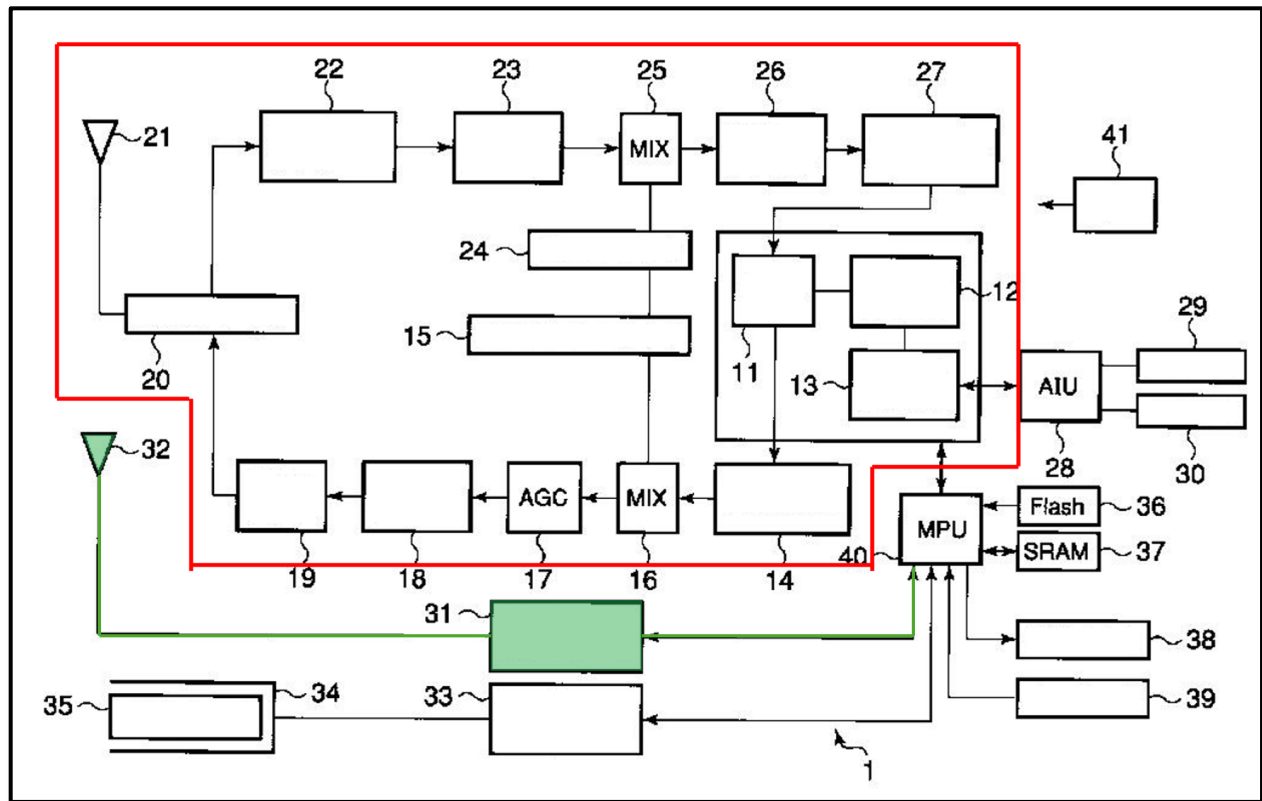
Suga’s Cellular Modem is a “Second Transceiver”

90. The cell phone is also equipped with cellular transceiver circuitry to transmit and receive data through a cellular connection:

The cell phone 1 has a modem 11, a channel CODEC unit 12, and a voice CODEC unit 13 as modem functions for phone line connections. The modem 11 modulates and demodulates the transmitted and received signals. The channel CODEC unit 12 performs coding and decoding of channel signals. The audio CODEC unit 13 performs coding and decoding of audio signals.

The cell phone 1 also has a quadrature modulator 14, frequency synthesizer 15, mixer 16, AGC unit 17, SAW filter 18, power amplifier 19, duplexer 20, antenna 21, low-noise amplifier 22, SAW filter 23, SAW filter 24, mixer 25, SAW filter 26, and quadrature demodulator 27 ***as signal transmitting and receiving functions for phone line connections.***

Id., [0029]-[0030], Fig. 2. The duplexer 20 “separates transmitted and received signals to and from the antenna” which in turn “exchanges signals with the outside world by means of cell phone radio waves.” *Id.*, [0031]. These cellular transceiver components are shown in the annotated Fig. 2 within the red boundary and are connected to the MPU (“operatively linked to said electronic circuit”).



Id., Fig. 2 (annotated). The cellular transceiver provides data communication to base station 2 through a wireless phone line. *See Id.*, Fig. 1.

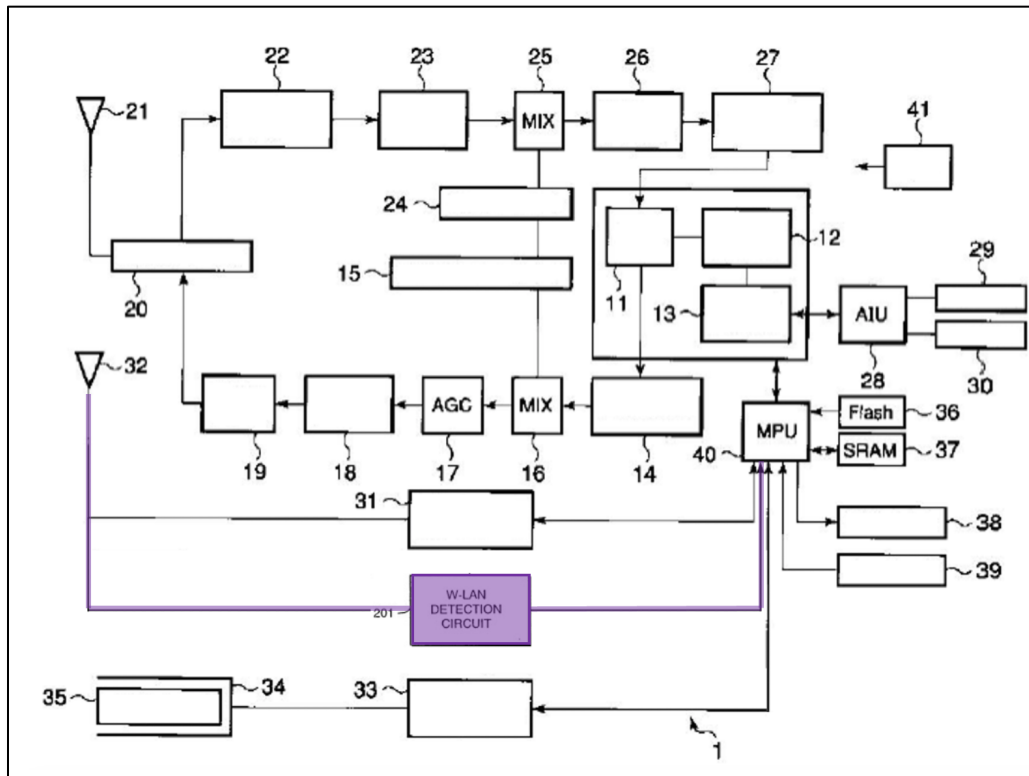
Suga's W-LAN and Cellular are Separate and Distinct Connections

91. A POSITA would also have understood that the wireless phone line and W-LAN line are distinct from each other. In fact, devices commonly had the ability to switch between these two networks, and POSITAs were concerned with making switching connections between these networks on a device as seamless as possible. Ex. 1011, 3-8. Each communicates through separate components in the cell phone 1, transmits data with different external devices, and each uses a different communication standard. For example, the cellular network discussed in *Gorsuch* is

a “Code Division Multiple Access (CDMA)” while the W-LAN protocol is the “IEEE 802.11” standard. *Gorsuch*, 2:8-9, 2:31-32. *Suga* also teaches that the W-LAN described is IEEE 802.11 compliant. *Suga*, [0039], [0041]. Therefore, the second communication link, a wireless phone line, is a “distinct from said first communication link[,]” the W-LAN line. A POSITA would also know that cellular systems in addition to using different standards, also used different frequency bands than W-LAN. The former used dedicated bands that were licensed to the service provider, while the latter used unlicensed bands at either 2.4GHz or 5GHz.

[1(e)] a cue receiver operatively linked to said electronic circuit for receiving an activation cue from a source external to said cellular phone;

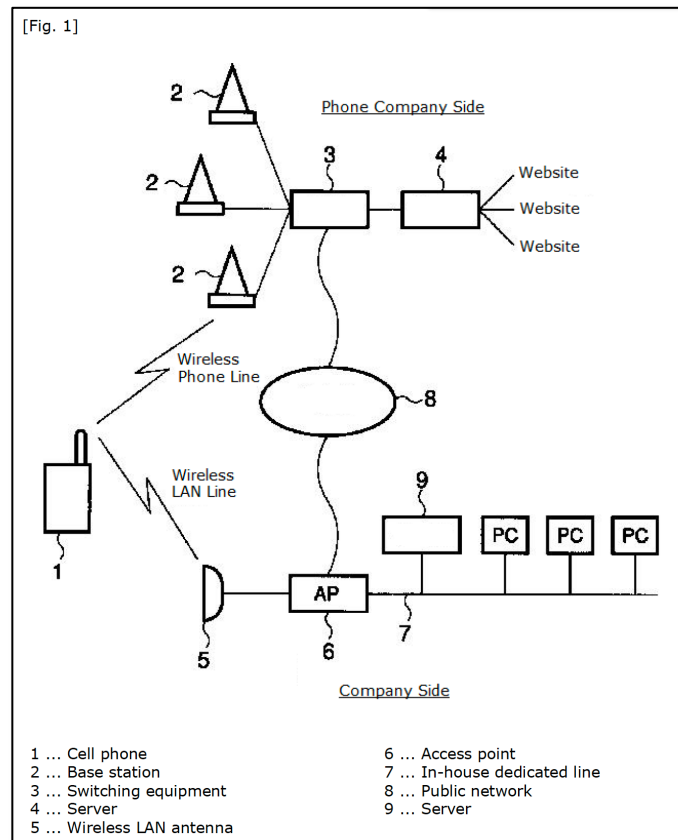
92. *Suga* in combination with *Gorsuch* discloses or suggests this limitation. As set forth in detail above, the proposed combination incorporates *Gorsuch*’s W-LAN detection circuit 201 (“cue receiver”) into *Suga*’s cellular phone to provide information on the availability of W-LAN. With this information, *Suga*’s MPU 40 (“electronic circuit”) can choose the proper transceiver for a data communication (e.g., an email transmission). *Suga*’s Figure 2 is annotated below to illustrate *Gorsuch*’s W-LAN detection circuit 201 inserted in parallel to *Suga*’s W-LAN transceiver circuitry and connected to MPU 40.



Suga, Fig. 2 (modified and annotated to show W-LAN detection circuit in *Suga*'s cellular phone).

93. *Gorsuch's* W-LAN detection circuit 201 that receives a beacon frame or beacon signal (“activation cue”) from a W-LAN base station 611, which is “a source external to said cellular phone[.]” *Gorsuch*, Abstract, 4:31-5:1, 13:14-22, 14:10-14, 16:1-12, Fig. 6. “IEEE 802.11 specifies that a beacon frame should be transmitted at regular intervals” by a W-LAN hub. *Gorsuch*, 13:17-18. A POSITA would have understood that *Suga's* access point 6, like *Gorsuch's* W-LAN base station 611, also emits a beacon signal. *Suga* discloses that the W-LAN transmitter of the cell phone is IEEE 802.11b, IEEE 802.11g, or IEEE 802.11a compliant. *Suga*,

[0039], [0041]. Each of these standards describes access points that transmit beacon frames which announce the presence of W-LAN to devices. *Id.*, [0039]-[0041]. Therefore, access point 6 of *Suga* emits a beacon signal. *See also* Ex. 1011, 39-40 (describing how access points under the 802.11 standard emit beacon signals). Further, access point 6 is external to cell phone 1, as the two are linked via a “wireless LAN line” (i.e., a wireless connection).

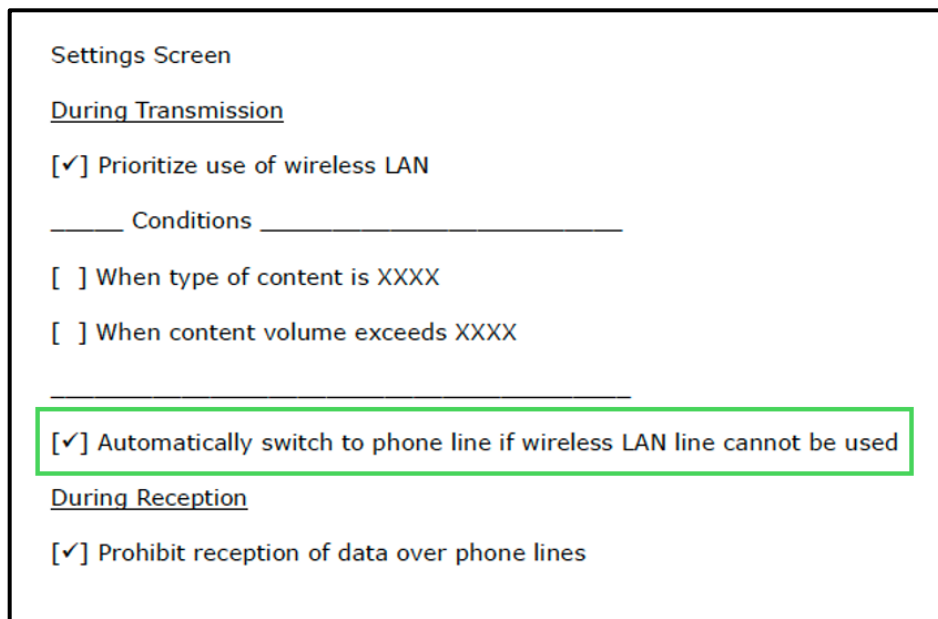


Suga, Fig. 1. *Suga*'s access point 6 is a wireless connection (connected by **wireless** LAN) to *Suga*'s cell phone and is, therefore, a source external to the cell phone.

[1(f)] a data conveyance switching element operatively linked to said electronic circuit, said switching element being assigned a first state upon an activation cue having been received by said cue receiver, and being assigned a second state when no activation cue was received by said cue receiver; and

94. *Suga* in combination with *Gorsuch* teaches this limitation. As discussed above, *Gorsuch*'s W-LAN detection circuit 201 provides information to the MPU 40, allowing the MPU to select the correct transceiver for a data transmission. *See* Section IX.C. In this combination, the MPU 40 itself is a “data conveyance switching element[.]” It decides which transceiver is used for a data transmission and is responsible for routing the data to the selected transceiver.

95. As discussed above in the summary of *Suga*, a settings screen permits users to dictate how and when cellular and W-LAN transmission is utilized. As shown in Fig. 5, cell phone 1 can be configured to prioritize W-LAN and to automatically switch to a cellular network when a W-LAN connection is unavailable. Additionally, a user can set conditions (e.g., data type and data volume) that cause the phone to attempt W-LAN communication. *Suga*, [0048-0049].



Id., Fig. 5 (annotated).

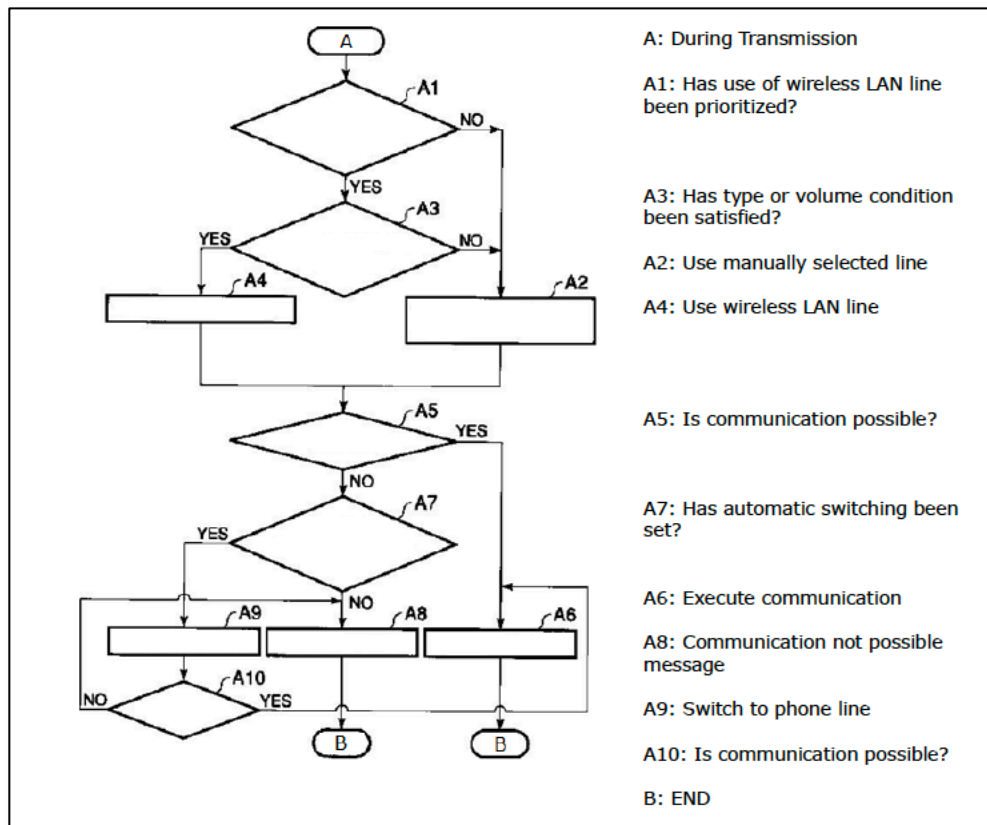
96. Fig. 6 (below) depicts a flowchart of the complete process conducted by *Suga*'s cell phone 1 when the user attempts to send data (for example, an email) if the phone is set to preferentially use wireless LAN. *Id.*, [0045], [0047]. At step A1, the system confirms that W-LAN should be prioritized. *Id.*, [0047]. At step A3, user set conditions are checked. *Id.*, [0048]. If these conditions are met,⁷ step A4

⁷ *Suga* teaches that the data type and data volume conditions can both be enabled or disabled. *Suga*, [0043]. A POSITA would have understood that disabling both conditions (while "prioritize wireless LAN" is enabled) results in a process flow that, for all data transmissions, attempts to use W-LAN prior to using cellular. That is, disabling both condition requirements means there are no data type or data volume conditions, and all data transmissions will satisfy step A3 (assuming the "Prioritize use of wireless LAN" setting is selected).

confirms the W-LAN transceiver will be used for the data transmission. *Id.*, [0049].

Step A5 analyzes whether communication is possible via the selected transceiver. In other words, in the *Suga/Gorsuch* combination, the state is checked – i.e., has an “activation cue” been received by the W-LAN detection circuit? If communication is possible with the W-LAN line, the communication is sent at step A6. *Id.*, [0050].

If communication with the W-LAN line is not possible, step A7 confirms that automatic switching has been set, switches the selected transceiver to cellular at step A9, confirms cellular transmission is possible at step A10, and executes transmission via the cellular connection at step A6. *Id.*, [0050]-[0052].



Id., Fig. 6.

97. In the proposed combination, *Gorsuch*'s W-LAN detection circuit 201 is used to determine whether a beacon signal has been detected. In the Fig. 6 process, this occurs at step A5. Namely, when MPU 40 implements the above method in the proposed combination, step A5 will result in "Yes" if *Gorsuch*'s W-LAN detection circuit 201 has detected a beacon signal. Detecting the beacon signal indicates to the system that communication over W-LAN is possible, which leads the process to selecting the W-LAN connection to complete a data transmission (i.e., the transmission is executed via W-LAN at step A6). That is, *Suga*'s cellular phone is in a "first state" as a result of having received an "activation cue," and sends data through the W-LAN connection as the preferred transmission type. *Suga*, [0049]-[0050] (describing performing communication through the W-LAN line where communication on that line is possible). Where a beacon signal (*activation cue*) is not detected, *Suga*'s cellular phone is in a "second state," and MPU 40 sends data using the wireless phone line instead. *Suga*, [0050]-[0052] (describing performing communication on the wireless phone line where communication on the W-LAN line is not possible). Because the choice of transceivers turns on whether W-LAN communications are "possible" and the proposed combination determines W-LAN availability based on the reception of a W-LAN beacon (*activation cue*), a POSITA would have understood that MPU 40 switches between the first and second state based on the beacon reception as indicated by *Gorsuch*'s W-LAN detection circuit.

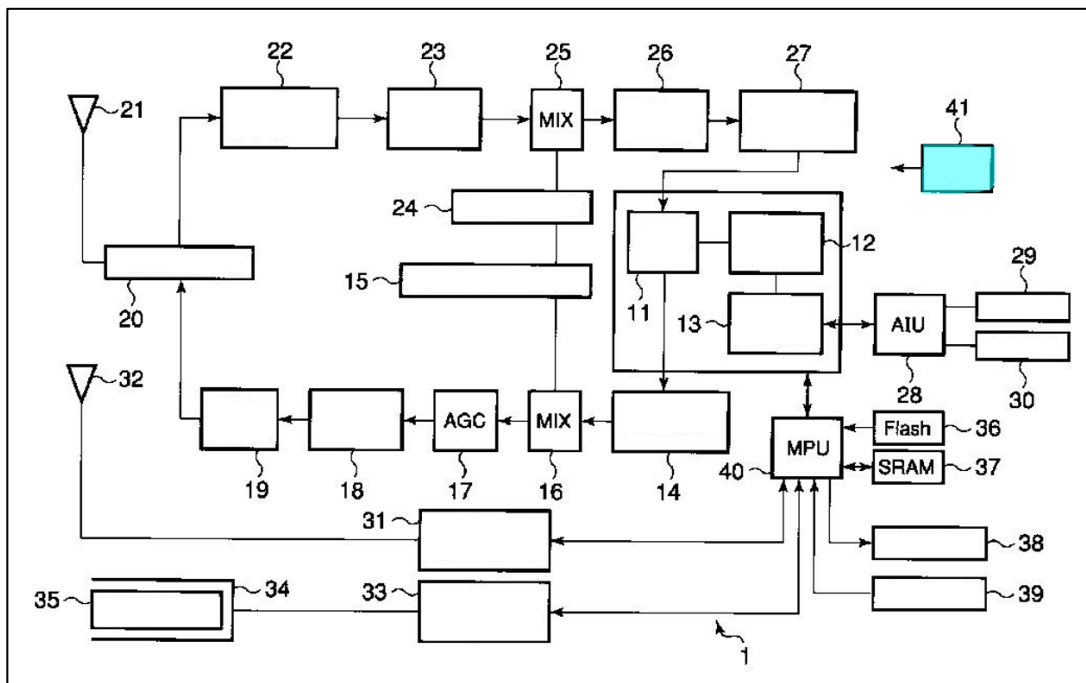
98. The '294 Patent teaches that the “switching element” can be “any type of device[,]” including “instructions programmed onto [a] microchip[,]” a “decisional logical circuit[,]” or “a physical structure, a virtual program, or both.” '294 Patent, 9:28-41. In the proposed combination, MPU 40 is a “data conveyance switching element[.]” It decides which transceiver is used for a data transmission and is responsible for routing the data to the selected transceiver. *Suga*'s MPU 40 implements switching functionality using a combination of software instructions and physical signal routing. The separate connections shown between the MPU and the W-LAN and cellular transceivers show that different physical signal routing is used for each transceiver. *See Suga*, Fig. 2. The software selects the correct physical routing to send the data through depending on the state of the device. Indeed, *Suga* expressly describes switching between transceivers within MPU 40:

The MPU 40 controls the operations of the entire cell phone 1. For example, the MPU 40 executes in the SRAM 37 a control program that realizes the line switching controls of the present embodiment and that controls switching between the circuit for phone line connections and the wireless LAN controller 31 for wireless LAN line connections.

Suga, [0037].

[1(g)] power means for providing power to said portable electronic device cellular phone;

99. *Suga* discloses this limitation. For example, *Suga* discloses that cell phone 1 includes electric components including an LCD panel 38, MPU 40, memory card 35, and wireless LAN controller 31. *Suga*, [0034]-[0036], Fig. 2. A “power supply 41 provides power to the components in the cell phone 1.” *Suga*, [0037], Fig. 2.



Suga, Fig. 2 (annotated).

[1(h)(i)] wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if said switching element is in said first state, a first data conveyance operation will be initiated through the instrumentality of said first data transceiver for sending data from said electronic circuit to the first external data exchange device over said first communication link;

and

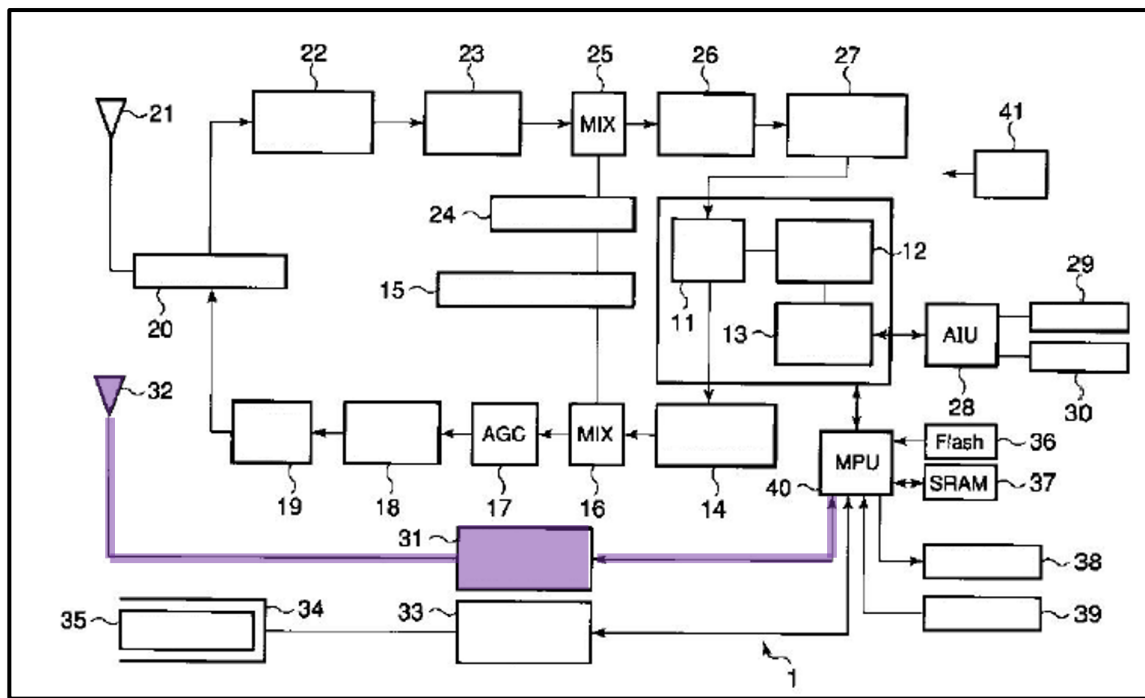
[1(h)(ii)] if said switching element is in said second state, a second data conveyance operation will be initiated through the instrumentality of said second data transceiver for sending data from said electronic circuit to the second external data exchange device over said second communication link.

100. *Suga* in combination with *Gorsuch* teaches these limitations. Summarizing these limitations, 1(h)(i) and 1(h)(ii) require that, upon user input, data is conveyed from the cellular phone along *one of two* different communication channels based on the state of the switching element. Each communication channel consists of a separate data transceiver on the device, a separate communication link (e.g. cellular or W-LAN), and a separate external data exchange device. The proposed *Suga-Gorsuch* combination uses the W-LAN detection circuit of *Gorsuch* to determine if W-LAN is available, allowing the cell phone of *Suga* to efficiently transmit data through W-LAN when available. If W-LAN is not available, the cellular network is used to transmit the user data (e.g., the user's email).

101. Specifically, a user inputs a command on the keyboard 39 ("selectively trigger[ing]" the "control device") of cell phone 1 to authorize sending an email, triggering an invariable activation command to be issued. *See* Claim [1(b)]. The user

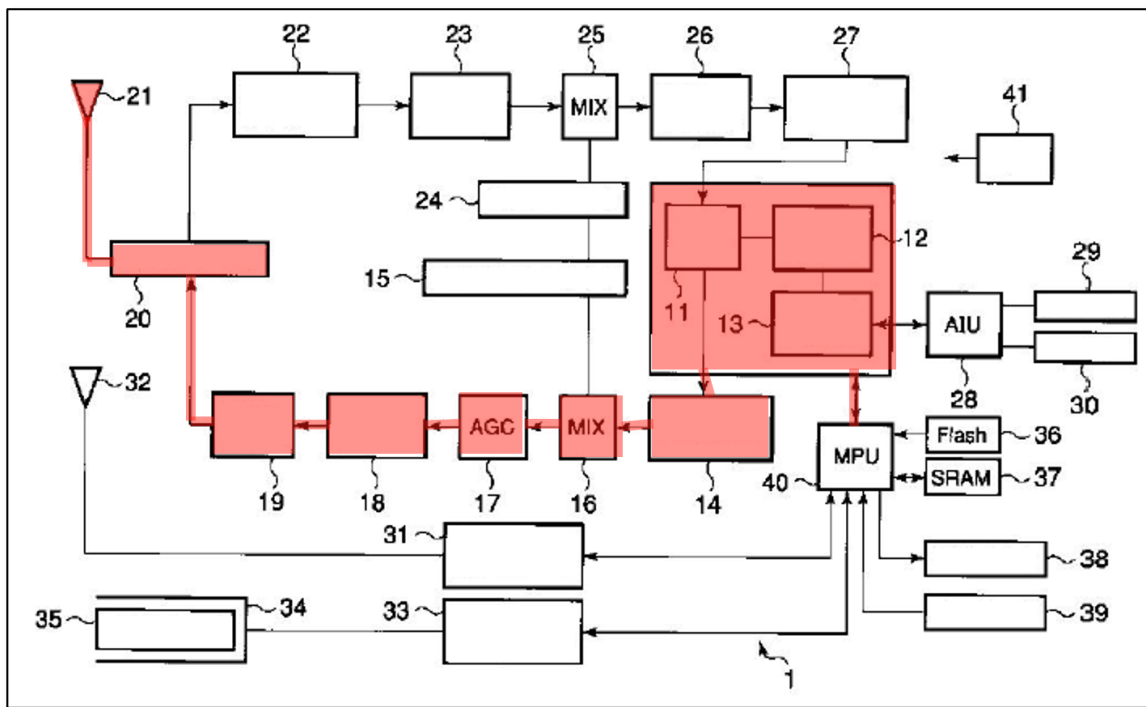
selection to send the email is processed by MPU 40 (part of the “electronic circuit” in *Suga*), which initiates the sending of the email data to an external device via either the W-LAN line or wireless phone line.

102. In the *Suga-Gorsuch* combination, MPU 40 constitutes a switching element that receives data on the presence or lack of a W-LAN beacon signal from the W-LAN detection circuit. *See* Claim [1(f)]. In a first state where a beacon is detected, the MPU will perform communication through the W-LAN line by routing the data through the wireless LAN controller 31 and antenna 32 as I have illustrated below.



Suga, Fig. 2 (annotated).

103. If no beacon signal has been detected, the MPU 40 is in a second state and will send data through the wireless phone line by routing the data through the cellular transceiver as I have illustrated below.

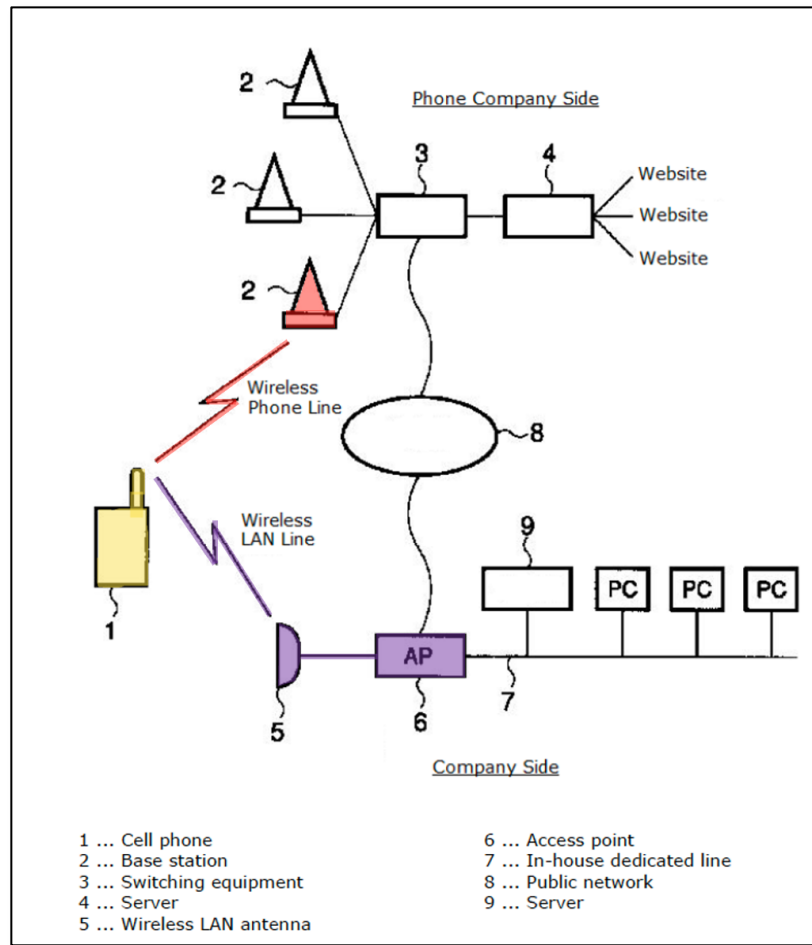


Suga, Fig. 2 (annotated).

104. *Suga's* W-LAN communications, as shown in annotated Fig. 1 below, are conducted over the W-LAN line (in purple below) (“first communication link”) between the W-LAN transceiver and the access point 6 (“first external data exchange device”). *Suga*, [0016]-[0017], Fig. 1; *see also* Claim [1(c)]. *Suga's* cellular communications, as shown in annotated Fig. 1 below, are conducted over the wireless phone line (in red below) (“second communication link”) between the

cellular transceiver and base station 2 (“second external data exchange device”).

Suga, [0016]-[0017], Fig. 1; *see also* Claim [1(d)].



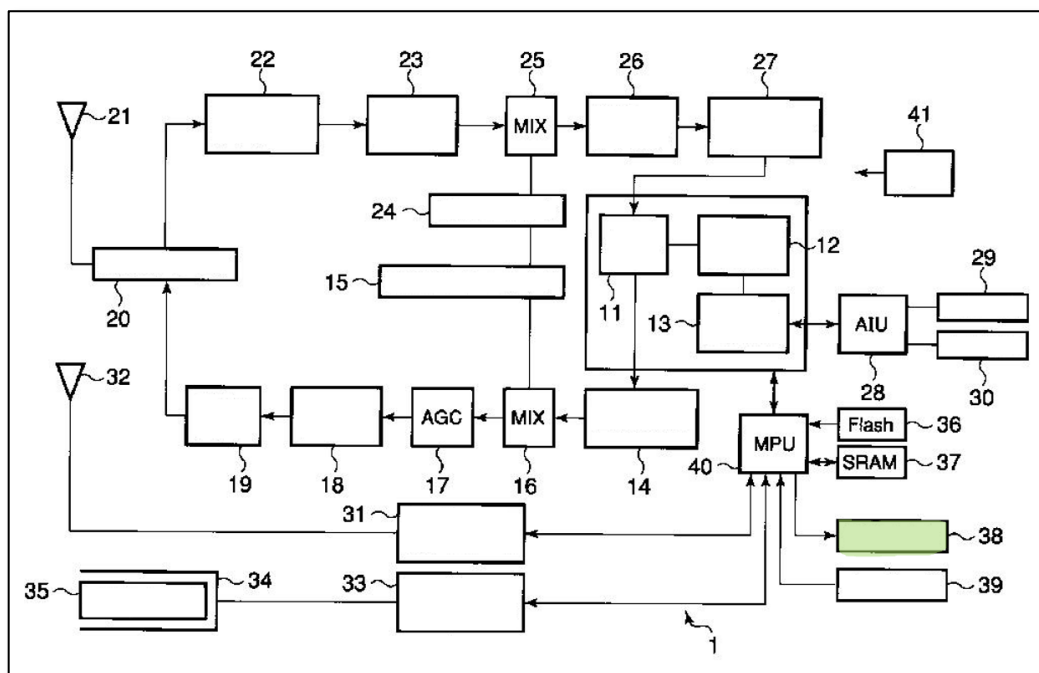
Suga, Fig. 1 (annotated excerpt).

B. Claim 2

A cellular phone as defined in claim 1, further comprising a display screen operatively linked to said electronic circuit.

105. *Suga* discloses this limitation. It was common for cellular phones at the time of the priority date to comprise a screen. *See* Ex. 1012, (describing state of the art cell phones, discussing various screens on said cell phones). For example, cell

phone 1 in *Suga* has an LCD panel which “is used to display various types of information on a screen.” *Suga*, [0036]. The screen is connected to the MPU 40 (part of the “electronic circuit”).



Suga, Fig. 2 (annotated).

C. Claim 3

A cellular phone as defined in claim 1, wherein said first data transceiver includes said cue receiver.

106. *Suga* in combination with *Gorsuch* teaches this limitation. In the proposed combination, *Suga*’s cell phone 1 is equipped with a first data transceiver (*Suga*’s W-LAN controller 31) and the claimed cue receiver (*Gorsuch*’s W-LAN detection circuit). See Claim [1(e)]. A POSITA would have understood that the W-LAN detection circuit and W-LAN controller 31 are collectively a W-LAN

transceiver. Both functional circuit blocks are connected in parallel between the W-LAN antenna and MPU 40 and together are capable of both receiving and transmitting data to an external access point over W-LAN. Therefore, the W-LAN detection circuit and W-LAN controller 31 collectively serve the role of a W-LAN transceiver.

107. Alternatively, a POSITA would have been motivated to implement *Suga's* W-LAN controller 31 and *Gorsuch's* W-LAN detection circuit as a single integrated unit. *Gorsuch* teaches that “[t]he various components of the subscriber unit 101 may be realized in discrete devices or as an integrated unit.” *Gorsuch*, 14:10-16. A POSITA would have recognized that both cost and size benefits can be realized by integrating these components into a single unit and would have been motivated to do so. Additionally, *Gorsuch* teaches that W-LAN detection can be passive or active. For active detection, a full W-LAN transceiver would be needed. Thus, a POSITA would find it obvious to have a single W-LAN transceiver, given that the two transceivers would be effectively the same.

D. Claim 4

A cellular phone as defined in claim 1, wherein said control device is one of a manually activated button, a keypad for receiving a PIN code, a biometric parameter detector and a combination thereof.

108. *Suga* in combination with *Gorsuch* teaches this limitation. As discussed for limitation 1(b), *Suga* discloses cell phone 1 having a keyboard 39. A POSITA

would have understood that a keyboard consists of various keys, each a “manually activated button[.]” A POSITA would have also understood a keyboard also satisfies the claimed option, “a keypad for receiving a PIN code.” Indeed, it was a common process at the time for a cell phone user to enter security PINs via the phone keyboard/keypad. *See* Ex. 1009, 15 (describing how to turn on contemporary cell phone using a PIN).

E. Claim 5

A cellular phone as defined in claim 1, wherein said electronic circuit includes said switching element.

109. *Suga* combined with *Gorsuch* teaches this limitation. In the proposed combination, MPU 40 functions as a switching element. *See* Section IX.C, Claim [1(h)]. The MPU 40 is part of the electronic circuit of the cell phone. *See* Claim [1(a)].

F. Claim 6

A cellular phone as defined in claim 5, wherein said electronic circuit comprises a microchip, and wherein said switching element is a series of instructions programmed onto said microchip.

110. *Suga* combined with *Gorsuch* teaches this limitation. *Suga* discloses that the cell phone 1 includes MPU 40 and SRAM 37. *Suga*, [0037] A POSITA would understand that the MPU 40 constitutes a microchip and the SRAM 37 is a short term memory used by the MPU 40 to execute functions. *Suga*, [0037]. A POSITA would understand that in the proposed combination, the switching element

is programmed onto the MPU 40 as a series of instructions to function as a switching element. *See* Claim [1(f)]. *Suga* contemplates switching between networks utilizing the MPU 40 and SRAM 37:

The MPU 40 controls the operations of the entire cell phone 1. For example, the MPU 40 executes in the SRAM 37 a control program that realizes the line switching controls of the present embodiment and that controls switching between the circuit for phone line connections and the wireless LAN controller 31 for wireless LAN line connections.

Suga, [0037]. Therefore, a POSITA would understand that the MPU 40 is programmed to switch between two data transmission states based on information obtained from the W-LAN detection circuit.

G. Claim 7

A cellular phone as defined in claim 1, wherein said switching element comprises a logical circuit.

111. The '294 Patent provides little detail regarding the claimed “logical circuit.” At best, it suggests that implementing switching element as a “decisional logical circuit” is an alternative to implementing switching element as “instructions programmed onto [a] microchip[.]” ’294 Patent, 9:33-40. To the extent Patent Owner contends that Claim 7 captures software-driven switching (e.g., software switching that relies on logical circuits), despite the patent distinguishing software implementations from logical circuit implementations, the proposed combination

satisfies this interpretation. *See* Claim [1(f)]. A POSITA would have understood that a processor such as MPU 40 consists of multiple logical circuits to run logical operations. Software, a set of logical operations, run on a processor causes logical circuits contained on the microprocessor to be triggered. As such, any software switching element that is implemented on a microprocessor must utilize at least one logical circuit. Therefore, a POSITA would understand that a software switch executed by a MPU 40 comprises a logical circuit.

H. Claim 8

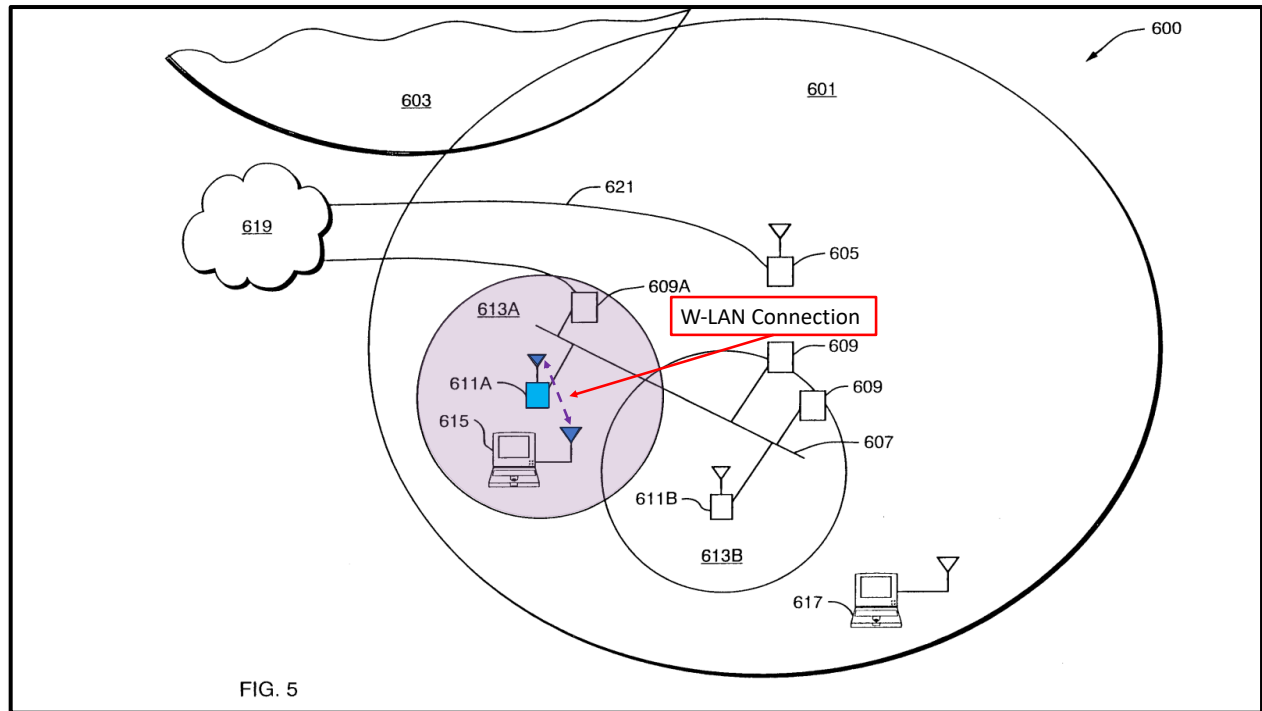
A cellular phone as defined in claim 1, wherein said first data transceiver comprises a proximity transceiver for accomplishing a wireless data exchange with a first external data exchange device through a direct link representing said first communication link where the cellular phone is conveyed toward a close proximity of the first external data exchange device and within a range to receive the activation cue to initiate the wireless data exchange.

112. *Suga* in combination with *Gorsuch* teaches the limitations of claim 8. In the proposed combination, *Suga*'s cell phone 1 transmits data to W-LAN access point 6. *See* Claim [1(h)]. A POSITA would have known that W-LAN access points such as access point 6 operate with limited range. As of the priority date, mobile devices were often capable of both cellular and W-LAN data transmissions. WLAN technologies provide better data rates but smaller coverage areas, while cellular networks have worse data rates but larger coverage areas. Ex. 1011, 1-2. As a result, WLAN is deployed in "hotspots like airports, conference sites, office building, cafes, hotels and university campuses." *Id.*, 14. However, WLAN is not suitable for

covering the wide areas of cellular networks. *Id.* Thus, WLAN access points are limited in range compared to wide area wireless networks such as a cellular network.

113. As *Gorsuch* explains, W-LAN hubs have regions of coverage 613, that are “generally of the order of tens or hundreds of feet, which is significantly smaller than the cells 601, 603 associated with [a cellular] network.” *Gorsuch*, 12:23-32, Fig. 5. Thus, a user device must be in proximity to the W-LAN hub, i.e., within the coverage region 613 shown in annotated Fig. 5, below, to receive a beacon frame and subsequently transmit data with a W-LAN hub 611. A POSITA would have understood that the access point 6 in the *Suga-Gorsuch* combination would have a similarly limited range. The ’294 Patent teaches, “[i]n one embodiment, first data transceiver 120 is a proximity transceiver that allows data transmission within a limited range, such as within several meters for example.” Ex. 1001, 15:55-57. However, the specification does not provide an example of the wireless communication technology used in this embodiment. A POSITA would understand that the range of several meters provided as an example in the disclosure is nonlimiting and that the range of the proximity transceiver can be shorter or longer depending on the wireless communication technology used. As shown in Fig. 5, the W-LAN (Wireless *local area* network) connection is limited in range, the device must be within the proximity of the base station/access point. *See* Ex. 1011, 1-2

(describing the limited range of W-LANs and their common deployment in various buildings).



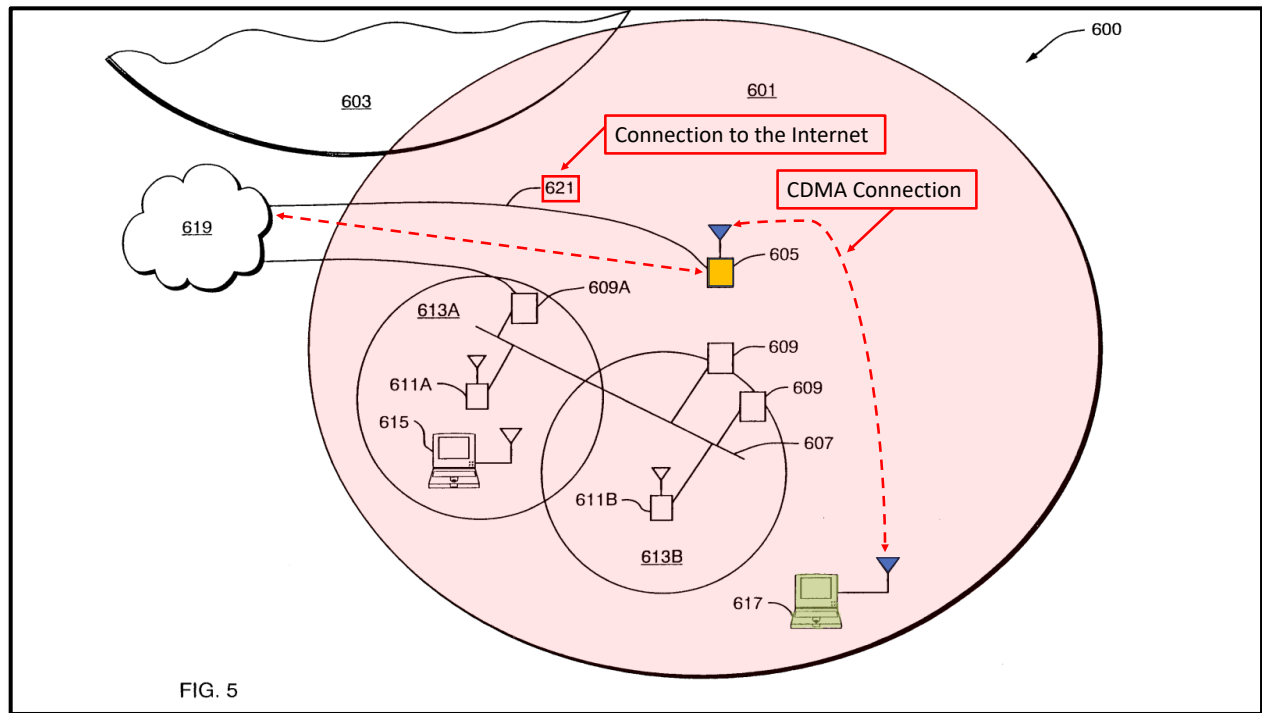
Gorsuch, Fig. 5 (annotated).

I. Claim 9

A cellular phone as defined in claim 8, wherein said second data transceiver comprises a communication network transceiver for wireless communication through a communication network that represents said second communication link, with one of a remote portable electronic device, a remote server, a remote terminal and a combination thereof.

114. *Suga* in combination with *Gorsuch* teaches the limitations of claim 9. For example, *Suga*'s cell phone 1 communicates using "cellular mobile communication services provided by a phone company" that connects the cell phone 1 "via a wireless phone line that connects to a base station 2" ("said second

communication link”), allowing the cell phone 1 to “exchange data with websites via an Internet connection service, and exchange data (such as sending and receiving email) with other information devices.” *Suga*, [0016], Fig. 1; *see also* Claim [1(d)]. A POSITA would have understood that *Suga*’s base station 2 constitutes a remote terminal. The specification does not provide any information on what constitutes a “remote terminal[.]” However, a POSITA would have understood a cellular base station covers a large range and connects with devices that are physically remote from the base station. The remote nature of a cellular base station is illustrated by *Gorsuch*. Namely, *Gorsuch*’s Fig. 5 below shows a device 617 connection to a cellular base station (base station 605), also a “remote terminal[.]” through a CDMA (cellular) connection, *Gorsuch*, Fig. 5. The cellular base station is itself connected to the Internet, allowing data exchange. A POSITA would have understood other cellular base stations, such as base station 2 of *Suga*, operate in a similar manner.



Gorsuch, Fig. 5 (annotated).

J. Claim 10

[10(Pre)] A cellular phone, comprising:

115. See Claim [1(Pre)].

[10(a)] an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output;

116. See Claim [1(a)].

[10(b)] a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, with said invariable activation command being issued when said control device is triggered by the user;

117. See Claim [1(b)].

[10(c)] first and second data conveyance operations programmed in said electronic circuit;

118. *Suga* in combination with *Gorsuch* teaches this limitation for at least the same reasons as presented above for limitations 1(b), (c), (f), (h)(i) and (h)(ii). *See* Claims [1(b)], [1(c)], [1(f)], [1(h)]. As described above, *Suga* in combination with *Gorsuch* discloses or suggests transmitting an email over a network, where the data is transmitted either via a W-LAN network for a first data conveyance operation or a cellular network for a second data conveyance operation. *See* Claim [1(h)].

119. In the proposed combination, the MPU 40 of *Suga* is responsible for performing the first and second data conveyance operations. *See* Section IX.C. *Suga* further discloses an electronic circuit including at least MPU 40 and memory card 35. MPU 40 “controls the operations of the entire cell phone 1.” *Suga*, [0037]. Memory card 35 “is used to store content handled by the cell phone 1.” *Suga*, [0035]. A POSITA would thus have understood that data conveyance operations are “programmed in” the memory card 35 of *Suga* and executed by MPU 40, each a part of the electronic circuit of cell phone 1.

[10(d)] a first data transceiver operatively linked to said electronic circuit, said first data transceiver being operable for data exchange over a first communication link;

120. *See* Claim [1(c)].

[10(e)] a second data transceiver operably linked to said electronic circuit, said second data transceiver being operable for data exchange over a second communication link that is distinct from said first communication link;

121. See Claim [1(d)].

[10(f)] a cue receiver operatively linked to said electronic circuit for receiving an activation cue from a source external to said cellular phone; and

122. See Claim [1(e)].

[10(g)] power means, for providing power to said cellular phone;

123. See Claim [1(g)].

[10(h)(i)] wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if an activation cue was received by said cue receiver, said electronic circuit will accomplish said first data conveyance operation to convey data from said electronic circuit to said first data transceiver for transmitting data through said first data transceiver; and

[10(h)(ii)] wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if no activation cue was received by said cue receiver, said electronic circuit will accomplish said second data conveyance operation to convey data from said electronic circuit to said second data transceiver for transmitting data through said second data transceiver.

124. See Claim [1(h)].

K. Claim 11

[11(Pre)] A data exchange system comprising:

125. If the preamble is limiting, *Suga* in combination with *Gorsuch* discloses this limitation. *Suga* discloses transmitting emails from a cell phone 1 to external devices (See Claim [1(a)]), and both *Suga* and *Gorsuch* discloses transmitting data through different wireless networks to different external devices. See Claims [1(c)],

8, 9. A POSITA would have understood that in the *Suga-Gorsuch* combination, which transmits data from the cell phone 1 to either access point 6 or base station 2, is “a data exchange system[,]” as claimed.

[11(a)] a first data exchange device;

126. *Suga* discloses this limitation. Namely, *Suga* discloses a W-LAN access point 6 (“a first data exchange device”). *Suga*, [0022], Fig. 1; *See* Claim [1(c)].

[11(b)] a second data exchange device; and

127. *Suga* discloses this limitation. Namely, *Suga* discloses a base station 2 capable of exchanging data with cell phone 1 via a wireless phone line. *Suga*, [0018], Fig. 1; *See* Claim [1(c)].

[11(c)] a cellular phone, including:

128. *See* Claim [1(Pre)].

[11(c)(i)] an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output;

129. *See* Claim [1(a)].

[11(c)(ii)] a user-triggered control device operatively linked to said electronic circuit, said user-triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, with said invariable activation command being issued when said control device is selectively triggered by the user;

130. *See* Claim [1(b)].

[11(c)(iii)] a first data transceiver operatively linked to said electronic circuit, said first data transceiver being for exchanging data between said electronic circuit and said first data exchange device through a direct link;

131. *Suga* alone or in combination with *Gorsuch* discloses this limitation for at least the reasons presented above in 1(c). See Claim [1(c)]. Additionally, a POSITA would understand that the W-LAN connection constitutes a direct link. See Claim 8.

[11(c)(iv)] a second data transceiver operatively linked to said electronic circuit, said second data transceiver being for exchanging data between said electronic circuit and said second data exchange device through a communication network that is distinct from said direct link;

132. See Claims [1(c)-1(d)].

[11(c)(v)] a cue receiver operatively linked to said electronic circuit for receiving an activation cue from said first data exchange device;

133. See Claim [1(e)].

[11(c)(vi)] a data conveyance switching element operatively linked to said electronic circuit, said switching element being assigned a first state upon an activation cue having been received by said cue receiver, and being assigned a second state when no activation cue was received by said cue receiver; and

134. See Claim [1(f)].

[11(c)(vii)] power means for providing power to said cellular phone;

135. See Claim [1(g)].

[11(c)(viii)(A)] wherein upon said control device being selectively triggered by the user to issue said invariable activation command: if said switching element is in said first state, a first data conveyance operation will be initiated through the instrumentality of said first data transceiver for exchanging data between said electronic circuit and the first external data exchange device;

[11(c)(viii)(B)] if said switching element is in said second state, a second data conveyance operation will be initiated through the instrumentality of said second data transceiver for exchanging data between said electronic circuit and the second external data exchange device.

136. See Claim [1(h)].

L. Claim 12

[12(Pre)] A method for data conveyance with a cellular phone of the type comprising: an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output, a user-triggered control device operatively linked to said electronic circuit, said user triggered control device configured to be operated by a user via one of a button, a keypad, a tactile screen, and a biometric parameter detector, and after being operated issue an invariable activation command, first and second data transceivers operatively linked to said electronic circuit, a cue receiver operatively linked to said electronic circuit, a data conveyance switching element operatively linked to said electronic circuit and capable of being in either one of a first and a second state, and power means for providing power to said cellular phone, said method comprising the steps of:

137. See Claims [1(Pre)-1(g)].

[12(a)] awaiting for an activation cue to be received at said cue receiver;

138. *Suga* in combination with *Gorsuch* discloses or suggests this limitation.

For example, *Gorsuch* discloses “waiting a minimum period of time” for the beacon frame (“activation cue”) to be received at W-LAN detection circuit 201 (“cue receiver”). *Gorsuch*, 13:14-22, 13:28-32; see also Claim [1(e)].

[12(b)] if an activation cue is received at said cue receiver, assigning said first state to said switching element, while if no activation cue is received at said cue receiver, assigning said second state to said switching element; and

139. See Claim [1(f)].

[12(c)] a user selectively triggering said control device to issue an invariable activation command whereby:”

140. See Claim [1(b)].

[12(d)(i)] if said switching element is in said first state, forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device over a first communication link; and

[12(d)(ii)] if said switching element is in said second state, forwarding second data to said second data transceiver for initiating a data exchange operation with a second external data exchange device that is distinct from said first communication link.

141. *Suga* in combination with *Gorsuch* teaches these limitations for at least the same reasons as presented above for limitations 1(h)(i) and 1(h)(ii). See Claim [1(h)].

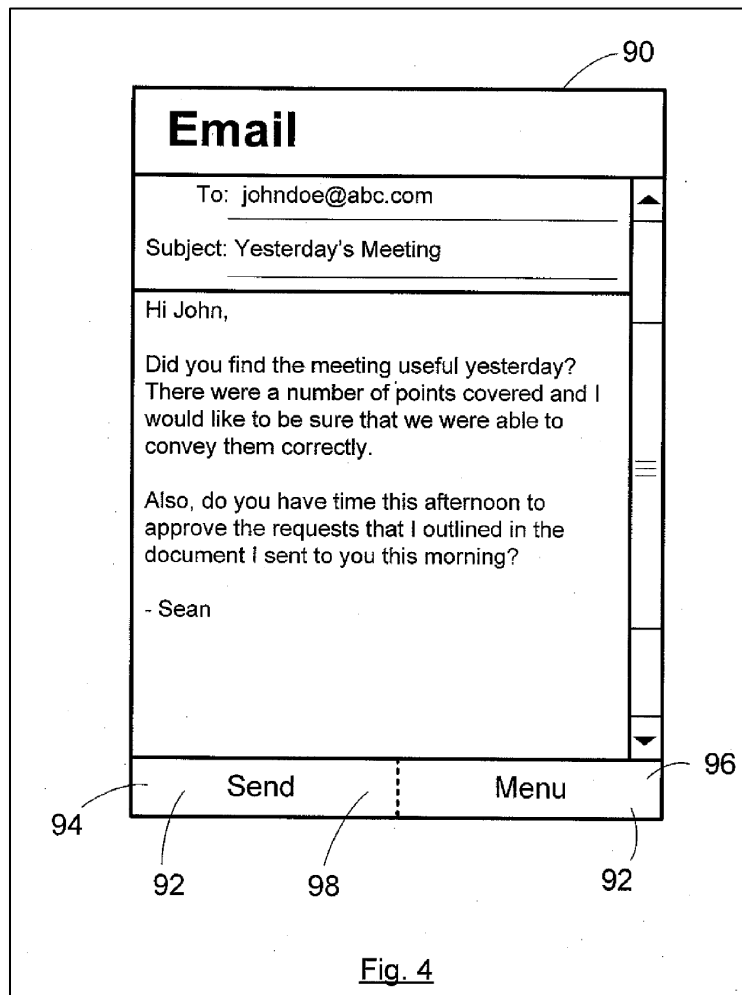
M. Claim 13

A method as defined in claim 12, further comprising the following step before the step of forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device:

forwarding third data to and displaying said third data on a display screen provided on said cellular phone, wherein said third data is representative of the content of said first data.

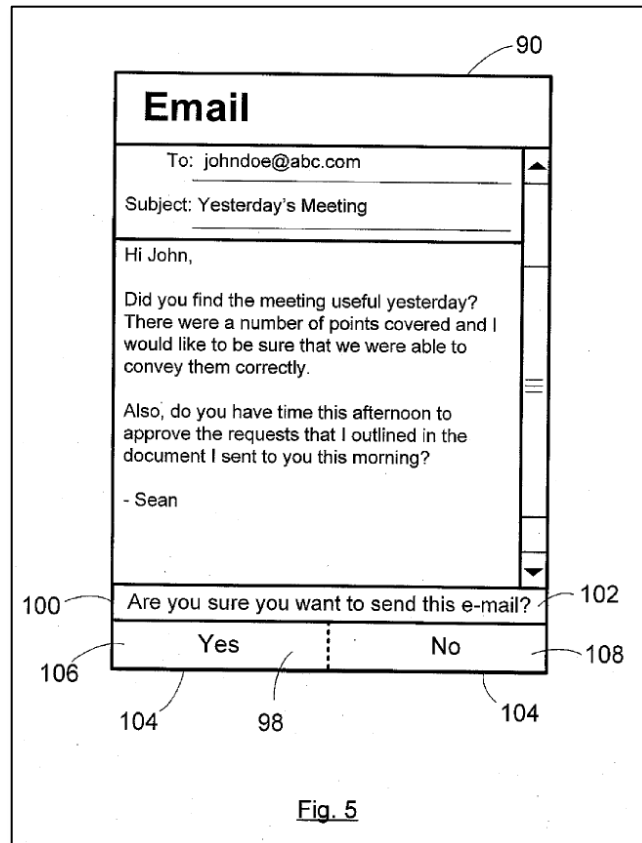
142. *Suga* in combination with *Gorsuch* teaches these limitations. *Suga* teaches displaying data on the LCD panel 38. See *Suga*, [0051]-[0052]. However, *Suga* does not describe the process to initiate an email send, including how the email

is displayed to the user, and how the user communicates that they wish to send the email. Although *Suga* does not describe what is displayed on the LCD panel 38 in the process of sending an email, a POSITA would have interpreted *Suga* to suggest displaying an email on the LCD panel before transmitting it. Indeed, it was well known in the art that an email would be displayed on the screen of a cell phone and provide a user the option to send the email. I have provided a sample of a known email display on a mobile device below. The contents of the email are shown on the screen of the device. Ex. 1010, [0029]-[0030].



Ex. 1010, Fig. 4.

143. In many mobile email systems, once the user commands the cell phone to send the email, another option will be presented on the screen to the user. The use of these confirmation boxes/dialog is intended to prevent the accidental transmission of emails that is possible with a single click send. Ex. 1013 (“*Sorotzkin*”), 1:16-32, 1:41-54; Ex. 1014 (“*Meister*”), 1:15-2:3. For example, after a user issues a command to send an email, a confirmation will appear on screen. Ex. 1010, [0002]-[0003], Fig. 5 (recognizing that after certain actions, like sending an email, a confirmation message will appear on the screen requiring an additional confirmation to send the email).



Ex. 1010, Fig. 5. A POSITA would have understood that the MPU 40 would “forward[] third data to” the LCD panel 38 so that the data would be presented. Because the MPU controls the operations of the entire phone, the MPU also sends data to the LCD panel through the electronic pathway shown in Fig. 2. *See Suga*, [0037]. This data is representative of the “first data[,]” as it is a confirmation message that the user desires to send the email. The '294 Patent notes that data does not have to be identical to be representative:

“The third data being representative of the first data means that the third data may indicate the type, nature or content of data included in the first

data, may include a portion of the data included in the first data, or may literally be identical to the first data.”

Ex. 1001, 15:34-38. An email displayed on a screen indicates the type, nature, and content of the transmitted email that comprises the first data, an email.

144. This step occurs prior to the “step of forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device” as a confirmation message requires an affirmative action from a user before the cell phone will attempt to send the email.

N. Claim 14

A method as defined in claim 13, wherein after the step of forwarding said third data to the display screen, the method comprises the following step:

awaiting for an authorization command to be inputted through a user confirmation input device provided on said cellular phone before forwarding said first data to said first data transceiver.

145. *Suga* in combination with *Gorsuch* teaches this element. As discussed above, *Suga* does not disclose the process to initiate sending an email, but these processes were well known in the art. A POSITA would have interpreted *Suga* to teach or suggest that the email is displayed by the LCD panel until a user wishes to send the email. A POSITA would further have interpreted *Suga* to teach or suggest waiting for user authorization before sending the email. Namely, once the user desires the email to be sent, the user presses a button on the keyboard 39. It was established in the art that this can trigger a confirmation message, where the device

waits for further input from a user before sending the email. *See* Ex. 1010, [0032]-[0037], Figs. 4 and 5 (describing a user pressing a key to send an email, a confirmation option message being presented alongside the email, and a user optionally confirming the user wishes to send the email); *Sorotzkin*, 4:34-49 (describing that after clicking the send button, a confirmation dialog is presented to the user, allowing the user an additional option to send or not send the email); *Meister*, 3:14-56 (describing a user requesting a message to be sent, a dialog box is displayed to the user in response, providing the user the options to send, modify, or erase the email). Finally, if a user confirms they wish the email to be sent, the email is forwarded by the MPU 40 to the relevant transceiver. When a confirmation is required, the email is not sent to any transceiver prior to receipt of the user confirmation. After pressing the initial send button, the device is “awaiting for an authorization command[,]” waiting for the user to confirm they want to send the email.

146. This step occurs after “forwarding said third data to the display screen” since the user would be unable to review the email on the display prior to the data being presented on the device. A user must first select to send an email prior to being provided with a confirmation option.

O. Claim 15

A method as defined in claim 12, wherein said first and second data are identical.

147. *Suga* in combination with *Gorsuch* teaches this limitation. When the cellular phone of the *Suga-Gorsuch* combination sends data via one of two transceivers, each the first and second data is an email. (See Claims [1(h)] and [12(d)]). Therefore, the first and second data are identical.

P. Claim 19

[19(Pre)] A method for data conveyance with a cellular phone of the type comprising: an electronic circuit capable of storing data therein, capable of processing data, and capable of data input and output, a control device operatively linked to said electronic circuit, first and second data transceivers operatively linked to said electronic circuit, a cue receiver operatively linked to said electronic circuit, a data conveyance switching element operatively linked to said electronic circuit and capable of being in either one of a first and a second state, and power means for providing power to said cellular phone, said method comprising the steps of:

148. If the preamble is limiting, *Suga* in combination with *Gorsuch* teaches these limitations for the same reason as presented above for 1(Preamble) through 1(g) and 12(Preamble). See Claims [1(Pre)-1(g)], [12(Pre)].

[19(a)] awaiting for an activation cue to be received at said cue receiver;

149. See Claim [12(a)].

[19(b)] if an activation cue is received at said cue receiver, assigning said first state to said switching element, while if no activation cue is received at said cue receiver, assigning said second state to said switching element; and

150. See Claim [12(b)].

[19(c)] selectively triggering said control device to issue an invariable activation command whereby:

151. See Claim [12(c)].

[19(c)(i)] if said switching element is in said first state, forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device over a first communication link; and

[19(c)(ii)] if said switching element is in said second state, forwarding second data to said second data transceiver for initiating a data exchange operation with a second external data exchange device over a second communication link that is distinct from said first communication link;

152. See Claim [12(d)].

[19(d)(i)] wherein said method further comprises the following steps before the step of forwarding first data to said first data transceiver for initiating a data exchange operation with a first external data exchange device: forwarding third data to and displaying said third data on a display screen provided on said cellular phone, wherein said third data is representative of the content of said first data; and

[19(d)(ii)] awaiting for an authorization command to be inputted through a user confirmation input device provided on said cellular phone before forwarding said first data to said first data transceiver; and

153. See Claims 13, 14.

[19(e)(i)] wherein said method further comprises the following steps before the step of forwarding second data to said second data transceiver for initiating a data exchange operation with a second external data exchange device: forwarding fourth data to and displaying said fourth data on said display screen, wherein said fourth data is representative of the content of said second data; and

[19(e)(ii)] awaiting for an authorization command to be inputted through said user confirmation input device before forwarding said second data to said second data transceiver.

154. *Suga* in combination with *Gorsuch* teaches this limitation for the same reason as presented above for 13, 14, and 15. *See* Claims 13-15. The *Suga-Gorsuch* combination teaches where the first and second data are identical (*see* Claim 15) and where the third data is representative of the content of the first data. *See* Claim 13. Where the first and second data are identical, the third and fourth data would be identical, as the fourth data is representative of the second data.

XI. CONCLUSION

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

Date: December 2, 2024

By: 
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Education

June 1996	Virginia Polytechnic Institute and State University, The Bradley Department of Electrical and Computer Engineering, Bradley Fellowship, Ph.D.
August 1993	The University of Toledo, Department of Electrical Engineering and Computer Science, M.S.
June 1991	The University of Toledo, Department of Electrical Engineering and Computer Science, B.S. <i>cum laude</i> .

Employment

Aug. 2012 - Present	Professor, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Director of <i>Wireless @ Virginia Tech</i>
Aug. 2006 – Aug. 2012	Associate Professor, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Mobile and Portable Radio Research Group.
Aug. 2009 – Dec. 2009	Visiting Researcher at the Laboratory for Telecommunication Sciences (LTS) a federal research lab which focuses on telecommunication challenges for national defense.
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”)
- Ellersick Best Paper Award 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 Teaching Excellence - April 2014.
- 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.
- Nominated for Teaching Certificate, College of Engineering, Spring 2004 and Spring 2005.
- 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
- Electric Circuits
- Signals and Systems
- Introduction to Communications
- Digital Communications
- Analog and Digital Communication Laboratory – *developed this course with \$70k grant from the State of Virginia.*

Graduate Courses

- Spread Spectrum Communications – *developed this course for the ECE department. It is now a permanent offering.*
- Advanced Digital Communications
- 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.*
- Information Theory
- Machine Learning for Communication Systems

Teaching Evaluations (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

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

- Jianyuan Yu, “The Application of Machine Learning to Dynamic Spectrum Access,” Ph.D. candidate, expected graduation, May 2020.
- Yue Xu, “ Deep Learning in Wireless Communication Systems,” Ph.D. candidate, expected graduation, May 2020.
- Charlie Thornton, “ Distributed Cognitive Radar,” Ph.D. candidate, expected graduation May 2023.
- William Howard, “ Distributed Learning Approached for Cognitive Radar and Radio,” Ph.D. candidate, expected graduation May 2023.
- Don-Roberts Emenonye, ” Machine Learning Approaches to Remote Rehabilitation,” Ph.D. candidate, expected graduation May 2023.
- Sam Shebert, ”Automatically Classifying Modern Communication Waveforms,” Ph.D. candidate, expected graduation May 2024.
- C. Tanner Fredieu, ”Classification Approaches for Electronic Warfare,” M.S. candidate, expected graduation May 2022.
- Sebastian Rodriguez, ”Advanced Signal Processing for Cognitive Radar,” M.S. candidate, expected graduation May 2022.

Former

- Chris O’Lone, “Statistical Analysis of Geolocation Fundamentals Using Stochastic Geometry,” Ph.D. December 2020.
- Jeff Poston, “ILoViT: Indoor Localization via Vibration Tracking,” Ph.D. March 2018.
- Mahi Abdelbar, “Applications of Sensor Fusion in Classification, Localization and Mapping,” Ph.D. February 2018.
- Mico Woolward, “SUPPLEMENTING LOCALIZATION ALGORITHMS FOR INDOOR FOOTSTEPS,” Ph.D., July 2017.
- Daniel Jakubisin, “Advances in Iterative Probabilistic Processing for Communication Receivers,” Ph.D., April, 2016, *currently employed by McGuire-Woods.*
- Jeannette Nounagnon “Using Kullback-Leibler Divergence to Analyze the Performance of Collaborative Positioning,” Ph.D., April, 2016, *currently employed by ComSat.*
- SaiDhiraj Amuru, “Intelligent Approaches for Communication Denial,” Ph.D., September, 2015, *currently employed by Samsung.*
- Javier Schloemann, “Fundamental Analyses of Collaborative and Noncollaborative Positioning,” Ph.D., August, 2015, *currently employed by Northrup-Grumman.*
- Reza Vaghefi, “Cooperative Positioning in Wireless Sensor Networks Using Semidefinite Programming,” Ph.D., December 2014, *currently employed by Blue Danube Labs.*
- Jeong-heon Lee, “Physical Layer Security for Wireless Position Location in the Presence of Location Spoofing,” Ph.D., March 2011, *currently employed by Samsung.*
- Haris I. Volos, “Cognitive Radio Engine Design For Link Adaptation,” Ph.D., September 2010, *currently employed by the University of Arizona.*
- Tao Jia, “Collaborative Position Location for Wireless Networks in Harsh Environments,” Ph.D., March 2010, *currently employed by Qualcomm, Inc.*
- Heba Shaban, “A Novel Highly Accurate Wireless Wearable Human Locomotion,” Ph.D., April 2010, *currently employed by Arab Academy of Science and Technology.*
- Haesoo Kim, “Cooperative Communications,” Ph.D., August 2008, *currently employed by LG Electronics.*
- Rekha Menon, - “Interference Avoidance based Underlay Techniques for Dynamic Spectrum Sharing,” Ph.D., April 2007, *currently employed by Tyco Electronics.*
- Swaroop Ventkatesh, “The Design and Modeling of Ultra-Wideband Position-Location Networks,” Ph.D., February 2007, *currently employed by Marvel Semiconductor.*
- Jihad Ibrahim, “Algorithms and Architectures for UWB Receiver Design,” Ph.D. January 2007, *currently employed by MathWorks.*
- 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.*
- Samir Al-Ghadhban - “ Multi-layered Space Frequency Time Codes,” Ph.D. October, 2005, *currently an associate professor at King Fahd University.*
- Jing Jiang – “Increasing the Capacity of Wireless Data Systems - A Cross Layer Perspective,” Ph.D., July 2004, *currently employed by Texas Instruments.*
- Jiann-An Tsai – “Overloaded Array Processing Using Interference Cancellation,” Ph.D., May 2002. *Currently employed by Samsung.*

- Daniel Tait, “Electromagnetic Vector-Sensor Direction-of-Arrival Estimation in the Presence of Interference,” M.S. August 2020.
- Don-Roberts Emenonye, “Application of Machine Learning to Multi-Antenna Transmission and Machine Type Resource Allocation,” M.S. July 2020.
- Charlie Thornton, “Learning Schemes for Adaptive Spectrum Sharing Radar,” M.S. May 2020.
- Mark Kozy, “Creation of a Cognitive Radar with Machine Learning: Simulation and Implementation,” M.S., May 2019.
- Bryse Flowers, “Adversarial RFML: Evading Deep Learning Enabled Signal Classification,” M.S., June 2019.
- Parker White, “Constrained Clustering for Frequency Hopping Spread Spectrum Signal Separation,” M.S., August 2019.
- Ersin Selvi, “Cognitive Radar Applied To Target Tracking Using Markov Decision Processes,” M.S. December 2017, *currently employed by Raytheon.*
- Ali Gaber Mohamed, “Navigating via Discrete Astronomical Radio Sources: Geolocation Using Fringe Rates,” M.S. April 2017, *currently employed by Alexandria University.*
- Eric Sollenberger, “Iterative Leakage-Based Precoding for Multiuser-MIMO Systems,” M.S., May, 2016, *currently employed by Qualcomm, Inc..*
- Kevin McDermott, “On the Improvement of Positioning in LTE with Collaboration and Pressure Sensors,” M.S., May, 2015, *currently employed by Northrup Grumman*
- Tori Jewell, “Use of GIS in Radio Frequency and Positioning Applications,” M.S. June 2014.
- Jacob Overfield, “The Impact of MIMO on Signal Localization,” MS, May 2013, *currently employed by n-ask, inc.*
- Zachary Biskaduros, “Collaborative GPS,” MS, June 2013, *currently employed by n-ask, inc.*
- 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.*
- Benton Thompson, “Characterization and Improvement of the Collaborative and Non-Collaborative Position Location Problems,” MS, August 2011, *currently employed by G3, Inc.*
- Corey Cooke, “Attenuation Field Estimation using Radio Tomography,” MS, August 2011, *currently a Ph.D. student at Georgia Tech.*
- Harpreet Dhillon, “The Optimal Sum-Rate of Multi-Band MIMO Interference Channel,” MS, July 2010, *currently an Assistant Professor at Virginia Tech.*
- Justin Kelly, “The Value of Collaboration in Dynamic Spectrum Access,” MS, July 2009, *currently employed by the Department of Energy.*
- Matthew Roney, “Dual-Channel Direction Finding in Multipath Channels,” M.S. candidate, *currently employed by DRS Signal Solutions.*
- Jesse Reed, “Approaches to Multiple-source Localization and Signal Classification,” MS, May, 2009, *currently employed by Arinc, Inc.*
- Chang Li, “Non-contact Estimation of Respiration and Heartbeat Rate using Ultra Wideband,” MS, August 20, 2008, *currently employed by Qualcomm, Inc.*
- Arjun Bhupathi Raju, “Characterization of Uplink Transmit Power and Talk-Time in WCDMA Networks,” MS, July 15, 2008, *currently employed by Qualcomm, Inc.*

- Rajaraman Parameswaran – “Effects of user and spatial diversity on high data rate wireless systems,” M.S., August 2005, *currently employed by Qualcomm Inc.*
- Nathan Harter, “Single Channel Direction Finding in Multipath Channels,” M.S., April 2007, *currently employed by IO-Max.*
- John Keaveny – “The Implementation of Single-Channel Direction Finding,” M.S., February 2005. *Currently employed by Boeing.*
- Brian Donlan, “Ultra-wideband Narrowband Interference Cancellation and Channel Modeling for Communications,” M.S., January 2005, *currently employed by IOMAX USA.*
- Vivek Baradwaj, “Ultra-Wideband for Communications: Spatial Characteristics and Interference Suppression,” M.S., April 2005. *Currently employed by Qualcomm, Inc.*
- Liu Yang, “On the Applicability of the Tap-delay Line Model to UWB Channel Modeling,” M.S., August 2004, *currently employed by Microsoft.*
- Dan Hibbard, “The Impact of Bandwidth on Indoor Communication System Performance,” M.S., May 2004. *Currently employed by Raytheon.*
- Nishant Kumar – “MAC and Physical Layer Design for Ultra-Wideband Communications,” M.S., May 2004. *Currently employed by Staccato Communicaitons.*
- Samir Ginde – “A Game-theoretic Analysis of Link Adaptation in Cellular Radio Networks,” M.S., May 2003. *Currently employed by Qualcomm, Inc.*
- Rahul Mahajan – “Cross Layer Optimization: System Design and Simulation Methodologies,” M.S., December, 2003. *Currently employed by Qualcomm, Inc.*
- Aaron Orndorf, “Transceiver Design for Ultra Wideband Communications,” M.S., completed May 2004.
- David McKinstry – “Channel Models and Receivers for Ultra Wideband Communications,” M.S., May 2003. *Currently employed by Johns Hopkins Applied Physics Lab.*
- Venkatasubramanian Ramasamy – “MC-CDMA/OFDM and Adaptive Antennas,” M.S., June 2002. *Currently employed by Apple.*
- Ray Chan – “Link Adaptation for Public Safety Wireless Information Networks,” M.S., June 2003. *Currently employed by Northrup Grummond Corp.*
- 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: “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%.
2. 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%

3. 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%
4. 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%
5. 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%
6. 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%
7. Title: "Cognitive Radar for C-SCoRE: Enhancing Radar Functionality though Interference Analysis and Avoid-
ance,"
Sponsor: Georgia Tech Research Institute (AFRL)
Funding: \$121,758
Period of Performance: December 15, 2018 June 30, 2020
Percent: 100%
8. Title: "Collaborative Learning for Harmonious Coexistence of Heterogeneous Wireless Networks"
Sponsor: Defense Advanced Research Agency
Funding: \$1,999,994
Period of Performance: January 1, 2017 - December 30, 2019.
Percent: 25%
9. Title: "MU-MIMO Channel Characterization"
Sponsor: GIRD Systems
Funding: \$117,712
Period of Performance: April 1, 2017 - March 31, 2019.
Percent: 100%
10. 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%
11. 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%
12. Title: "Hyper-wideband Communications"
Sponsor: Defense Advanced Research Projects Agency

- Funding: \$182,451
Period of Performance: May 1, 2015 - April 30, 2016.
Percent: 50%
13. 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%
14. 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%
15. 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%
16. Title: "Improving Cellular Positioning through Collaboration"
Sponsor: Polaris Wireless
Funding: \$82,813
Period of Performance: 11/01/2013 - 10/31/2014
Percent: 100%
17. 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%
18. 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%
19. 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%
20. 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%

21. 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%
22. 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%
23. Title: "IHCS: Proactive Cross-Layer Adversary Localization for Hostile or Harsh Wireless Environments"
Sponsor: NSF
Funding: \$494,788
Period of Performance: 5/1/08 4/30/11
PI: Y. Yang
Co-PIs: R.M. Buehrer and J.M. Park
Percent: 33%
24. 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-PIs: Y. Yang
Percent: 85%
25. 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-PIs: R.M. Buehrer, C. Bostian, A. MacKenzie, and J.H. Reed
Percent: 25%
26. 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%
27. 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%
28. 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%

29. 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%
30. 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%
31. 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%
32. 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-PIs: J.H. Reed, Scott Midkiff, R. M. Buehrer, W.H. Tranter, Peter Athanas, Tom Hou, Binoy Ravindran, Rick Habayeb
Percent: 10%
33. 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%
34. Title: UWB Communications
Sponsor: Motorola
Period of Performance: 12/15/03 12/14/04
Funding: \$35,000
PI: Buehrer
Percentage: 100%
35. 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%
36. 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%
37. Title: Indoor Propagation
 Sponsor: Qualcomm, Inc.
 Funding: \$14,000
 Period of Performance: 12/1/03 5/15/04
 PI: R.M. Buehrer
 Percent: 100%
38. 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%
39. 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%
40. Title: UWB Propagation Measurements, Modeling, and Communication System Enhancements
 Sponsor: DARPA
 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%
41. 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%
42. 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%
43. 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-PIs: R.M. Buehrer, W.H. Tranter, S.W. Ellingson, others
Percent: 20%

Book Publications

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

S. Zekavat and R.M. Buehrer, editors, Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.

J.H. Lee and R.M. Buehrer, "Security Issues in Position Location," Chapter 3 in Position Location - Theory, Practice and Advances, Wiley-IEEE, 2011.

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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.

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R.M. Buehrer, An Introduction to Code Division Multiple Access (CDMA), Morgan-Claypool Publishers, 2007.

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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.

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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.

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.

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

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, *accepted for publication in International Journal of Wireless Information Networks*, January 2021.

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.

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.

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.

R. Shahanaghi, R.M. Buehrer, and Y. Yang, “Stochastic Link Modeling of Static Wireless Sensor Networks Over the Ocean Surface,” *IEEE Transactions on Wireless Communications*, vol. 19, no. 6, pp. 4154-4169, June 2020.

C.E. OLone, H. Dhillon, and R.M. Buehrer, “Single-Anchor Localizability in 5G Millimeter Wave Networks,” *IEEE Wireless Communications Letters*, vol. 9, no. 1, pp. 65-69, January 2020.

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.

S. Aditya, H. Dhillon, A.F. Molisch, R.M. Buehrer and H.M. Behairy, “Characterizing the Impact of SNR Heterogeneity on Time-of-Arrival-Based Localization Outage Probability,” *IEEE Transactions on Wireless Communications*, vol. 18, no. 1, pp. 637-649, Jan. 2019.

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M. Z. Win, R. M. Buehrer, G. Chrisikos, A. Conti, and H. Vincent Poor, “Foundations and Trends in Localization Technologies Part 2”, *Proceedings of the IEEE*, vol. 106, no. 7, pp. 1132 - 1135, July 2018.

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J. Poston, P. Tarazaga, and R.M. Buehrer, “Indoor Footstep Localization from Structural Dynamics Instrumentation,” *Mechanical Systems and Signal Processing*, vol. 88, pp. 224-239, May, 2017.

S. Amuru, H. Dhillon, and R.M. Buehrer, “On Jamming Against Wireless Networks,” *IEEE Transactions on Wireless*

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D.J. Jakubisin and R.M. Buehrer, "Approximate Joint MAP Detection of Co-Channel Signals in Non-Gaussian Noise," *IEEE Transactions on Communications*, vol. 64, no. 10, pp. 4224-4237, October 2016.

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R. M. Buehrer, C. R. Anderson, R. K. Martin, N. Patwari, and M. G. Rabbat, "Introduction to the Special Issue on Non-Cooperative Localization Networks", *IEEE Journal on Selected Topics in Signal Processing*, vol. 8, no. 1, pp. 2-4, January 2014.

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C.R. Anderson, H.I. Volos, and R. M. Buehrer, "Characterization of Low Antenna Ultra Wideband Propagation in a Forest Environment," *IEEE Transactions on Vehicular Technologies*, vol. 62, no. 7, pp. 2878-2895, July 2013.

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- M. Baidas, R.M. Buehrer, and A.B. MacKenzie, “Network-Coded Bi-Directional Relaying for Amplify-and-Forward Cooperative Networks: A Comparative Study,” *IEEE Transactions on Wireless Communications*, vol. 12, no. 7, pp. 3238 – 3252, July 2013.
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N. V. Rivera, S. Venkatesh, and R.M. Buehrer, "Non-invasive Wireless Application of Ultra Wideband (UWB) for Estimation of Single and Multiple Person Vital-Signs," *2006 Engineering in Medicine and Biology Conference*, New York, August 30-September 3, 2006.

J. Ibrahim and R.M. Buehrer, "A UWB Multiple Antenna System for NBI Mitigation under Rayleigh and Ricean Fading," *2006 IEEE International Conference on Communications*, pp. 3953–3959, Istanbul, Turkey, June 11-15, 2006.

S. Venkatesh, and R.M. Buehrer, "Power Control in UWB Position-Location Networks," *2006 IEEE International Conference on Communications*, pp. 3953–3959, Istanbul, Turkey, June 11-15, 2006.

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N. Harter, J. Keaveny, S. Venkatesh, and R.M. Buehrer, "Analysis and Implementation of a Single Channel Direction Finding System," *IEEE Military Communications Conference (MILCOM2005)*, pp. 2530–2533, Atlantic City, NJ, October 2005.

J. Ibrahim, R. Menon, and R.M. Buehrer, "UWB Sequence Optimization for Enhanced Energy Capture and Interference Mitigation," *IEEE Military Communications Conference (MILCOM2005)*, pp. 2086-2092, Atlantic City, NJ, October 2005.

J. Ibrahim and R.M. Buehrer, "Two-Stage Acquisition for UWB in Dense Multipath," *IEEE Military Communications Conference (MILCOM2005)*, pp. 1898-1904, Atlantic City, NJ, October

2005.

S.Venkatesh, C.R. Anderson, N.V.Rivera and R.M. Buehrer, "Implementation and Analysis of Respiration-Rate Estimation using Impulse-based Ultra-Wideband," *IEEE Military Communications Conference (MILCOM2005)*, Atlantic City, NJ, October 2005.

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N. Harter, J. Keaveny, S. Venkatesh, and R.M. Buehrer, "Analysis and Implementation of a Novel Single-Channel Direction-Finding Method," *Wireless Communications and Networking Conference*, pp. 2530 - 2533, New Orleans, LA, 13-17 March 2005.

S. Venkatesh, J. Ibrahim, and R. M. Buehrer, "A new 2-cluster model for indoor UWB channel measurements," *IEEE AP-S International Symposium and UNSC/URSI National Radio Science Meeting*, pp. 946- 949, June 2004.

J. Jiang, R. M. Buehrer, and W. H. Tranter, "High-speed downlink packet transmission with spatial multiplexing and scheduling," *Wireless Communications and Networking Conference, WCNC 2004*, pp. 2148 - 2152, Atlanta, GA, March 2004.

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N.A. Kumar and R.M. Buehrer, "Application of Layered Space-Time Processing to Ultra-Wideband Communication," *45th IEEE Midwest Symposium on Circuits and Systems*, Tulsa, OK, pp. 597-600, August 4-7, 2002.

P. Jain and R.M. Buehrer, "Implementation of Adaptive Modulation on Sunrise Software Radios," *45th IEEE Midwest Symposium on Circuits and Systems*, Tulsa, OK, pp. 405-408, August 4-7, 2002.

R. Venkatasubramanian, J. Tsai, and R. M. Buehrer, "Beamforming for MC-CDMA," *45th IEEE Midwest Symposium on Circuits and Systems*, Tulsa, OK, pp. 441-444, August 4-7, 2002.

D.R. McKinstry and R.M. Buehrer, "Issues in the Performance and Covertness of UWB Communications Systems," *45th IEEE Midwest Symposium on Circuits and Systems*, Tulsa, OK, pp. 601-604, August 4-7, 2002.

J. Neel, R.M. Buehrer, J.H. Reed, and R.P. Gilles, "Game theoretic analysis of a network of cognitive radios," *45th IEEE Midwest Symposium on Circuits and Systems*, Tulsa, OK, pp. 409-412, August 4-7, 2002.

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R.M. Buehrer, S. Arunachalam, and K. Wu, "Spatial Channel Model and Measurements for IMT-2000 Systems," *53rd IEEE Vehicular Technology Conference – VTC Spring 2001*, Rhodes, Greece, vol. 1, pp. 342-246, May 2001.

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S.P. Nicoloso, M. Metke, and R.M. Buehrer, "Frame-Quality-Based vs. Eb/No-Based Forward Power Control Methods for cdma2000," *10th Virginia Tech Symposium on Wireless Personal Communications*, Blacksburg, VA, pp. 239-248,

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J.-A. Tsai, R.M. Buehrer, and D. Uptegrove, "Performance Comparisons of Adaptive Antenna Arrays with Fixed Multibeam Systems for TDMA Systems," *49th IEEE Vehicular Technology Conference – VTC Spring 99*, Houston, TX, vol. 2, pp. 1079-1083, May 1999.

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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.

N.S. Correal, R.M. Buehrer, and B.D. Woerner, "Real-Time DSP Implementation of a Coherent Partial Interference Cancellation Multiuser Receiver for DS-CDMA," *IEEE International Conference on Communications - ICC*, Atlanta, GA, vol. 3, pp. 1536-1540, May 1998.

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N. Correal, R.M. Buehrer, and B.D. Woerner, "Improved CDMA Performance Through Bias Reduction for Parallel Interference Cancellation," *International Conference on Personal, Mobile, and Indoor Radio Conference*, Helsinki, Finland, vol. 2, pp. 565-569, September 1997.

N. Correal, R.M. Buehrer, and B.D. Woerner, "DSP Implementation of Parallel Interference Cancellation," *Symposium on Interference Rejection and Signal Separation in Wireless Communications*, George Washington University, Washington, D.C., (proceeding pages unnumbered), March 1997.

R.M. Buehrer, N.S. Correal, and B.D. Woerner, "A Comparison of Multiuser Receivers for Cellular CDMA," *IEEE Global Telecommunications Conference '96*, London, England, pp. 1571-1577, November 11-18, 1996.

J. Feil, L. Ippolito, M. Buehrer, G. Feldhake, and S. Horan, "The First Two Years of Experimental Results from the New Mexico ACTS Propagation Terminal at 20.185 and 27.505 GHz," *1996 IEEE International Symposium on Antennas and Propagation*, Baltimore, MD, vol. 3, pp. 1868-1871, July 21-26, 1996.

J. Feil, L. Ippolito, M. Buehrer, G. Feldhake, and S. Horan, "First Year Propagation Experiment Results from the New Mexico ACTS Receiver Terminal at 20.185 and 27.505 GHz," *16th AIAA International Communications Satellite Systems Conference*, Washington, D.C. pp. 1-11, February 1996.

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.

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.

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.

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.

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.

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.

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

- Area Editor, *IEEE Transactions on Wireless Communications*, 2017 - present.

- 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 i
- 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.
- 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.

Expert Witness Experience

- Tesla, Inc.
 - Law firm: Munger, Tolles, & Olson
 - Served as testifying expert witness
 - Technology: Control channels/information in cellular systems
 - Dates: November 2020 - present
- Apple, Inc.
 - Law firm: Wilmer-Hale
 - Wrote declaration in support of request for ex parte reexamination
 - 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 declaration supporting petitioner.
 - Technology: Cell selection and reselection in Radio Resource Control
 - Dates: April 2020 - June 2020
- Apple, Inc. vs. Optis
 - Law firm: Wilmer-Hale
 - Represented: Apple (Plaintiff)
 - Served as testifying expert witness for litigation
 - 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
 - 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.
 - 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)
 - 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.

- Technology: Traffic mapping between logical channels and transport channels in Wireless Systems; Multi-mode transceivers
- Dates: September 2018 - November 2019.
- Apple, Inc. vs. Wi-LAN
 - Law firm: DLA Piper
 - Represented: Apple (Plaintiff)
 - Served as testifying expert witness for litigation (infringement analysis and non-infringing alternatives)
 - Technology: Resource Allocation in Wireless Systems
 - District: Southern District of California
 - Dates: Fall 2017 - July 2018
- CCE vs. Apple, Inc.
 - Law firm: DLA Piper
 - Represented: Apple (Defendant)
 - Served as testifying expert witness for litigation (infringement analysis)
 - 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).
 - 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.
- 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. Case settled before trial, but after depositions were taken.
 - 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.