

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Katagishi et al.
U.S. Pat. No.: 6,973,334 Attorney Docket No.: 35548-0082IP1
Issue Date: Dec. 6, 2005
Appl. Serial No.: 10/142,051
Filing Date: May 10, 2002
Title: CELLULAR TELEPHONE

DECLARATION OF MARK R. LANNING

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I, Mark R. Lanning, of Greenville, TX, declare that:

I. ASSIGNMENT

1. I have been retained as a technical expert by counsel on behalf of Huawei Technologies Co., Ltd. (“Huawei” or “Petitioner”). I understand that Huawei is requesting that the Patent Trial and Appeal Board (“PTAB” or “Board”) institute *inter partes* review (“IPR”) proceedings of U.S. Patent No. 6,973,334 (“the ’334 patent”) (Ex. 1001).

2. I have been asked to provide my independent analysis of the ’334 patent in light of the prior art publications cited below.

3. I am not, and never have been, an employee of Huawei. I received no compensation for this declaration beyond my normal hourly compensation based on my time actually spent analyzing the ’334 patent, the prior art publications cited below, and the issues related thereto, and I will not receive any added compensation based on the outcome of any IPR or other proceeding involving the ’334 patent.

II. QUALIFICATIONS

4. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this declaration.

5. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. A copy of my current curriculum vitae, which details my education as well as my professional and academic experience, is attached below. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

6. I am currently the President of three consulting companies: Telecom Architects, Inc., I.N. Solutions, Inc., and Reticle Consulting, LLC. All three companies provide professional consulting services and custom software development for one or more particular technical areas. Telecom Architects, Inc. was established in 1999 to provide specialized consulting services to fixed and wireless telecom service providers and their suppliers. I.N. Solutions¹ (Intelligent Networking Solutions) was established in 1991 with an emphasis on applications design and network architecture engineering for telephone-based switching and Advanced Intelligent Networking systems. Reticle Consulting was created in 2009 to provide specialized consulting services for forensic software analysis and software source code comparison for misappropriation cases.

7. I have over 40 years' experience in a wide variety of communication

¹ I.N. Solutions, Inc. is no longer active.

technologies including, but not limited to, different types of circuit-switched and packet-switched networks, cellular networks and their components, advanced cellular network based services (including code division multiple access (CDMA) networks), Public Switched Telephone Network (“PSTN”) networks, VoIP networks, Advanced services that use Intelligent Networking (“AIN”) network elements, and various signaling protocols (*e.g.*, Signaling System 7 (“SS7”) and Integrated Digital Services Network (“ISDN”)).

8. I have developed software for many types of computer systems ranging in size from large scale distributed computer systems that used hundreds of computers down to a single personal computer. I have also used many different types of operating systems and programming languages, which includes creating software applications that interfaced with operating systems for at least: process creation and scheduling; memory management; and interprocess communication.

9. My communications experience began in 1976 while I was enlisted in the U.S. Army Signal Corps. Specifically, I worked in the U.S. Army Security Agency (ASA) where I was a member of a technical team responsible for upgrading worldwide voice and data communications used by the White House staff and other government agencies.

10. Beginning in 1984, I was a member of a team responsible for converting a PSTN switch into a cellular mobile switching center that Motorola

and other companies used extensively in cellular networks located in the U.S. and other countries.

11. I have also been a member or manager of development teams that built cellular network elements and specialized cellular applications. These network element types include at least: base station; home location register; short and multimedia message centers; intelligent peripherals; personal number plans; and pre-paid billing systems. These applications include, but are not limited to, creating, processing, and delivering Short Message Service (SMS) and Multimedia Message Service (MMS) messages in cellular networks and cellular phones.

12. Since 1991, I have been responsible for the design and implementation of multiple packet-switched networks and their required interfaces to different circuit-switched networks. Examples of these networks are British Telecom, Nextel, and Sprint. These networks include much of the functionality that is used today in packet switched networks and similar to the technology of the '334 patent.

13. Since 1995, I have also provided second generation (2G) and third generation (3G) Code Division Multiple Access (CDMA) network architecture and equipment design and implementation consulting services to companies such as Sprint, Nextel, Nokia, and Ericsson. While consulting to Nextel, which has since become part of Sprint, as one of the network architects for its iDEN network, one

of my responsibilities was to define the network and mobile phone functionality required to support the Multimedia Messaging Service (MMS) and advanced data communications capability.

14. Through my work in the cellular industry and my litigation experience as an expert witness, I understand various cellular phone communication and handover methods. I also understand how the functionality in cellular network architectures has changed to support increased use of cellular telephones and other wireless communication devices and what capabilities were present in cellular communications systems over the course of the mid to late 90's and early 2000's.

15. I have consulted for cellular phone suppliers, e.g., Nokia and Ericsson, to verify the phone's functionality operated correctly for 911 emergency calls and to ensure device compatibility and connectivity between the devices and those of third-party Bluetooth headsets.

16. In addition to my experience listed above, for at least the past ten years, I have been updating my knowledge of the present-day 3G, 4G, and 5G cellular network and wireless standards and their associated equipment and protocols through my study of each new release of these standards, technical books, and trade publications as well as my expert work in legal cases, which has involved evaluating the functionality of many different types of network equipment, mobile devices, baseband chipsets, and thousands of cellular oriented

patents.

17. I am a member of the Institute of Electrical and Electronics Engineers (IEEE), including the IEEE Standards Association. I am also a member of the Association for Computing Machinery (ACM). I was also a member of the American National Standards Institute (ANSI) T1 and T1X1 standard groups responsible for the definition and standardization of the Advanced Intelligent Network (AIN) and Signaling System 7 (SS7) protocol.

18. I received my Bachelor of Science degree in Computer Science from Southern Methodist University (SMU) in 1983. More detail on my education, work experience and the cases that I have previously given testimony within at least the past four years is contained in my attached CV.

19. Based on my experience and education, I believe that I am qualified to opine as to the knowledge and level of skill of one of ordinary skill in the art at the time of the alleged invention of the '334 patent (which I further describe below) and what such a person would have understood at that time, and the state of the art during that time.

III. LEGAL PRINCIPLES

20. In forming my analysis and conclusions expressed in this declaration, I have applied the legal principles described in the following paragraphs, which were provided to me by counsel for the Petitioner.

A. Obviousness

21. I have been informed that a patent claim is invalid as “obvious” under 35 U.S.C. § 103 in light of one or more prior art references if it would have been obvious to a person of ordinary skill in the art at the time of the alleged invention (“POSITA”), taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any so called “secondary considerations” of non-obviousness, which include: (i) “long felt need” for the claimed invention, (ii) commercial success attributable to the claimed invention, (iii) unexpected results of the claimed invention, and (iv) “copying” of the claimed invention by others. While I do not know the exact date that the alleged invention claimed in the ’334 patent was made, I do know that the ’334 patent claims priority to a foreign application filed November 10, 1998 (Ex. 1001, cover page). For purposes of my analysis here, I have applied a date of November 10, 1998 as the date of the alleged invention in my obviousness analysis, although in many cases the same analysis would hold true even if the date of the alleged invention occurred earlier than November 10, 1998 (especially given the earlier publication or filing dates of the prior art in Exhibits 1004, 1005, 1006, 1007, 1008, 1009, and 1010 as described below). *See, infra*, ¶26.

22. I have been informed that a claim can be obvious in light of a single

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

B. Claim Construction

23. I understand that, for purposes of my analysis in this *inter partes* review proceeding, the terms appearing in the patent claims should be interpreted according to their “ordinary and customary meaning” under the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). In determining the ordinary and custom meaning, the words of a claim are first given their plain meaning. *Id.* According to *Phillips*, the structure of the claims may breathe additional meaning into the claims, and the specification and file history also may

be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. Moreover, *Phillips* offers that even treatises and dictionaries may be used, albeit under limited circumstances, to determine the meaning attributed by a person of ordinary skill in the art to a claim term at the time of filing. I have followed this approach in my analysis, and for all of the claim terms considered in this Declaration, I have applied the plain and ordinary meaning of those terms.

24. I also understand that the words of the claims should be interpreted as they would have been interpreted by a POSITA at the time the alleged invention was made (not today). Because I do not know at what date the alleged invention was made, I have used the date of November 10, 1998 for reasons explained in ¶21 (above) and ¶26 (below). However, the plain meanings/interpretations that I employed in my analysis below would have also been correct if the date of invention was anywhere within the mid to late 1990s.

IV. PERSON OF ORDINARY SKILL IN THE ART

25. Based on my knowledge and experience in the field and my review of the '334 patent and file history, I believe that a POSITA would have had at least a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and at least two years of experience in the field of wireless communications systems, or an equivalent advanced education in the field of wireless communications systems. My analysis and conclusions as expressed

herein are thus based on the perspective of a person of ordinary skill in the art having this level of knowledge and skill at the time of the '334 patent.

26. Because I do not know at what date the alleged invention as claimed was made, I have used the filing date of the earliest application to which the '334 patent claims priority as the point in time from which my analysis from the perspective of one of ordinary skill in the art is based. Again, as previously explained, that date was November 10, 1998. However, my analysis of the prior art and the conclusion herein would also apply even if the date of the alleged invention as claimed was anywhere within the mid to late 1990s (e.g., refer to the earlier publication or filing dates of Exs. 1004, 1005, 1006, 1007, 1008, 1009, and 1010).

V. MATERIALS CONSIDERED

27. My analyses set forth in this declaration are based on my experience in the field of wireless communications systems and associated technologies. Based on my above-described experience in the field of wireless communications systems, I believe that I am considered to be an expert in the field. Also, based on my experiences, I understand and know of the capabilities of persons of ordinary skill in this field during the mid to late 1990s and specifically during the time before the alleged priority date (November 10, 1998) for the '334 patent, and I participated in organizations, and worked closely with many such persons in the

field during that time frame.

28. As part of my independent analysis for this declaration, I have considered the following: the background knowledge/technologies that were commonly known to persons of ordinary skill in this field during the time before the alleged priority date for the '334 patent; my own knowledge and experiences gained from my work experience in the fields of electrical engineering and wireless communications systems generally; my experience in teaching and advising others in those subjects; and my experience in working with others involved in those fields. In addition, I have analyzed the following publications and materials:

- U.S. Pat. No. 6,973,334 to Katagishi et al. (“the '334 patent”) (Ex. 1001)
- File History of the '334 Patent (Ex. 1002)
- U.S. Pat. No. 5,452,473 to Weiland et al. (“Weiland”) (Ex. 1004)
- U.S. Pat. No. 5,430,760 to Dent (“Dent”) (Ex. 1005)
- U.S. Pat. No. 5,752,172 to Matero (“Matero”) (Ex. 1006)
- U.S. Pat. No. 5,392,460 to Mattila (“Mattila”) (Ex. 1007)
- U.S. Pat. No. 5,841,768 to Ozluturk et al. (“Ozluturk”) (Ex. 1008)
- U.S. Pat. No. 5,799,010 to Lomp et al. (“Lomp”) (Ex. 1009)
- U.S. Pat. No. 5,589,796 to Alberth, Jr. et al. (“Alberth”) (Ex. 1010)

- Plaintiff Maxell, Ltd.’s Patent Rule 3-1 and 3-2 Disclosure of Asserted Claims and Infringement Contentions Against the Huawei Defendants in *Maxell, Ltd., v. Huawei Device USA Inc. and Huawei Device Co., Ltd.* (Case No. 5:18-cv-00033) (E.D.Texas) (Ex. 1011)

29. Although this Declaration refers to selected portions of the cited references for the sake of brevity, it should be understood that these are examples, and that one of ordinary skill in the art would have viewed the references cited herein in their entirety and in combination with other references cited herein or cited within the references themselves. The references used in this Declaration, therefore, should be viewed as being incorporated herein in their entireties.

VI. BACKGROUND OF THE '334 PATENT

A. Relevant Technology Overview

30. The technology area of the purported invention of the '334 patent is power amplifiers. Specifically, how the power, signal amplitude and voltage bias are controlled in a power amplifier for a cellular phone to achieve the stated benefits.

31. The '334 patent admits that it was known that a cellular telephone had transmit power control circuitries that were controlled by a control processor so as to control and adjust the power level of transmission power. Ex. 1001 at 1:12-25. The '334 patent also admits that it was known that these power control circuitries

included: 1) a variable amplitude amplifier; 2) a power amplifier; 3) a controller to supply the gain control signal to the variable amplitude amplifier and a level detector; and 4) a level detector that supplies a bias signal to the power amplifier for adjusting the transmitted power. *Id.* at 1:26-41.

32. A “variable amplitude amplifier” was also known as a “variable gain amplifier” as shown below by the prior art references and as supported by the Patent Owner’s infringement contentions, which state “[o]n information and belief, these devices include different bias and gains associated with different operating conditions of the variable amplitude/gain amplifier.” Ex. 1011, Appendix. 9 at p. 68.

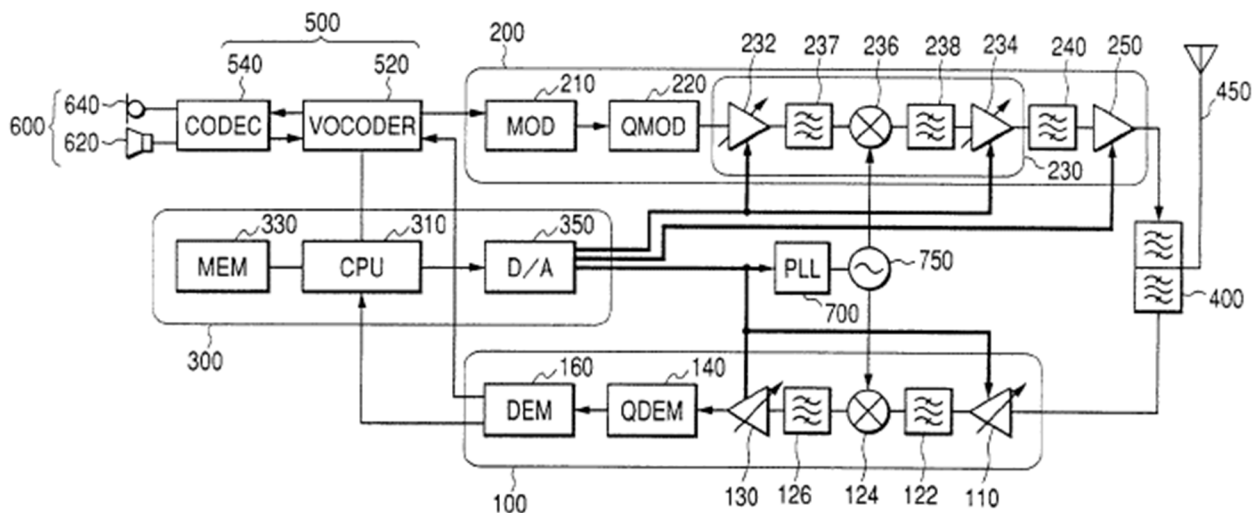
33. The ’334 patent further admits that it was known that a level detector was used to measure the level of the gain control signal and make corresponding adjustments to the bias control signal for the power amplifier. Ex. 1001 at 1:39-47. However, the ’334 patent states that, in the prior art, these corresponding adjustments to the bias control signal were made based on the gain signal level crossing a threshold level, which made abrupt changes to gain control signal resulting in abrupt changes to the amount of current used by the amplifier. *Id.* at 1:41-47. The ’334 patent also states that “large current consumption shortens the battery life, which shortens the hours of communication on the phone.” *Id.* at 2:9-11. The ’334 patent’s purported improvement over the known prior art includes a

controller that controls the gain of the variable amplitude amplifier and a bias condition of the power amplifier according to a function stored in memory. *Id.* at 2:43-48.

B. Overview of the '334 Patent

34. The '334 patent describes “a cellular telephone used in Code Division Multiple Access (CDMA) system.” Ex. 1001 at 1:9-11. The cellular telephone of the '334 patent is shown in FIG. 1 below:

FIG. 1



Ex. 1001 at FIG. 1. The cellular telephone includes a receiver 100, a transmitter 200, a controller 300, an encoder/decoder apparatus 500, a duplexer 400, an antenna 450, and an acoustic transducer 600. Ex. 1001 at 4:36-40. The antenna 450 transmits communication signals transferred from the transmitter 200 and provides received communication signals to the receiver 100. Ex. 1001 at 4:40-48.

35. The receiver 100 includes a quadrature demodulator 140 that demodulates the communication signal and a base band demodulator 160 that converts the demodulated signal into a voice code signal. Ex. 1001 at 4:49-60. The voice code signal is converted to an audio signal by encoder/decoder apparatus 500 and provided to a speaker 620 of the acoustic transducer 600. Ex. 1001 at 5:1-13.

36. A microphone 640 of the acoustic transducer 600 provides an audio signal to the encoder/decoder apparatus 500, which converts the audio signal to a voice code signal. Ex. 1001 at 5:14-19. The voice code signal is provided to the transmitter 200 where it is modulated by modulators 210 and 220 into a communication signal. Ex. 1001 at 5:19-34.

37. The '334 patent describes prior art transmit power control circuits controlled by a control processor to control and adjust transmission power level. Ex. 1001 at 1:13-19. As an example, the '334 patent describes a prior art transmitter applying the IS-95 standard for a CDMA cellular telephone system as including a variable amplitude amplifier, a power amplifier, a controller, and a level detector. Ex. 1001 at 1:26-47. Like the prior art circuits, the '334 patent's transmitter includes a variable amplitude amplifier, a power amplifier, and a controller. The conventional transmitter is shown in FIG. 11 below, and the '334 patent's transmitter is shown in FIG. 2 below:

FIG. 11 RELATED ART

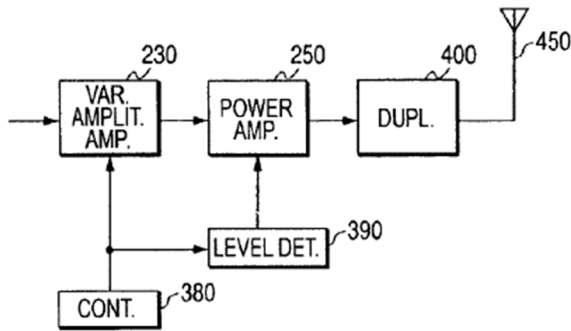
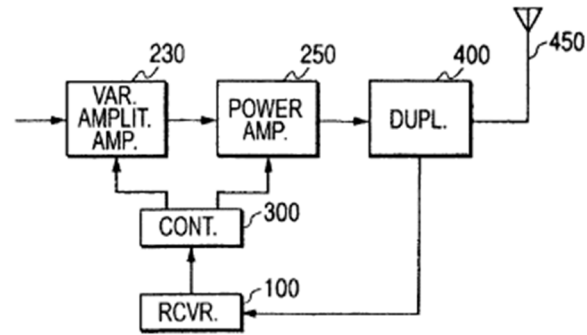


FIG. 2



Ex. 1001 at FIG.11 and FIG. 2.

38. The '334 patent concedes that controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier was well-known prior to the '334 patent. Ex. 1001 at 1:34-46. Referring to the conventional transmitter of FIG. 11, the '334 patent explains that the controller 380 supplies a gain control signal to the variable amplitude amplifier 230 to adjust the gain of the variable amplitude amplifier for the required transmitter output power. Ex. 1001 at 1:34-37. The level detector 390 detects a level of the gain control signal and supplies a bias signal to the power amplifier 250. Ex. 1001 at 1:37-46.

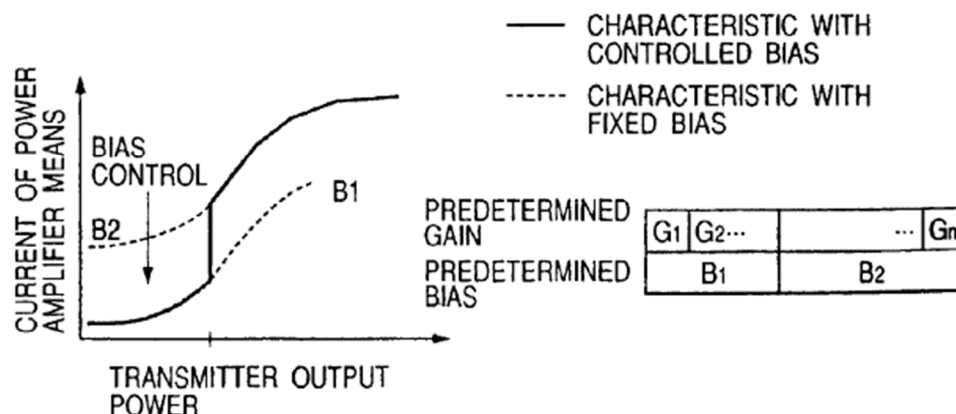
39. The '334 patent also admits that conventional techniques provide open-loop power control and closed-loop power control. As the '334 patent explains, the IS-95 standard employs open-loop power control and closed-loop power control such that “the transmitter performs the open-loop power control at first, then it performs the closed-loop power control for the transmitted power to converge into a desired value which the cell-site station requires.” Ex. 1001 at

1:47-61.

40. In general, when operating in open loop power control, the transmitter does not get received power level feedback from the cell-site station, so it is required to make transmit power level adjustments independently. In contrast, for closed loop power control, the transmitter receives power level feedback information from the cell-site station that it uses to adjust the transmitted power.

41. According to the '334 patent, the prior art transmitters consume more current, which shortens battery life. The '334 patent states that these prior art devices consume more power by changing the bias of the power amplifier abruptly, which causes the current of the power amplifier to also change abruptly. These abrupt changes are made when the received gain control signal crosses a threshold value, as shown in FIG. 12 below. Ex. 1001 at 1:41-47, 2:9-11, FIG. 12.

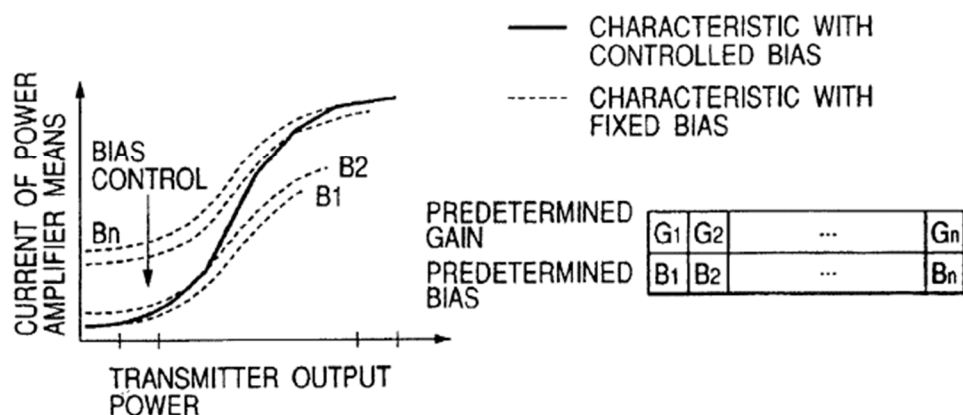
FIG. 12 RELATED ART



Ex. 1001 at FIG. 12. The '334 patent purports to provide an improvement over the

prior art transmitter by providing a controller that uses bias values for the power amplifier corresponding to each gain value. Ex. 1001 at 6:5-60. Sets of gain and bias values are used such that the value of the bias decreases as the value of the gain decreases. Ex. 1001 at 6:31-34. The current of the power amplifier thus increases when the output power increases, as shown in FIG. 4 below.

FIG. 4



Ex. 1001 at FIG. 4.

42. The bias values used for an input to the power amplifier are defined as a function of predetermined values of the gain of the variable amplitude amplifier stored in memory. Ex. 1001 at 6:40-45. The function is stored in the memory, and the bias values calculated using the function can also be stored in the memory. Ex. 1001 at 6:45-48. The controller controls the variable amplitude amplifier and the power amplifier using the function or the sets of values stored in the memory. Ex. 1001 at 6:48-51, 7:25-43. The '334 patent states that “[s]ince the current of power

amplifier means are lower than that of the fixed bias condition Bn, a range of transmitter output power where current consumption in the power amplifier means are reduced is much broader than that of the related art.” Ex. 1001 at 6:54-58. As I explain in greater detail below, these features were well-known in the area of wireless communications before the earliest asserted priority date of the ’334 patent, as exemplified by the Weiland reference.

C. File History of the ’334 Patent

43. As part of my preparation of this declaration, I reviewed the file history of the ’334 patent (Ex. 1002). I understand that the application that led to the ’334 patent was filed on May 10, 2002, and claimed priority to a Japanese application that was filed on November 10, 1998. *See* Ex. 1001, Cover Page. The ’334 patent eventually issued on December 6, 2005. *Id.*

44. The USPTO issued a first office action on August 10, 2004. Ex. 1002 at 94-97. In the office action, the examiner rejected claims 8-10 based on obviousness-type double patenting as being unpatentable over claims 1-7 of U.S. Patent No. 6,408,193. Ex. 1002 at 96. In response, the applicant submitted a terminal disclaimer. Ex. 1002 at 105-114. The applicant also added new claims 11-17. Ex. 1002 at 108-113.

45. The USPTO issued a final office action on March 25, 2005 allowing claims 8-10 and 15-17 and rejecting claims 11-14 over prior art. Ex. 1002 at 120-

131. In the statement of reasons for the indication of allowable subject matter, the examiner copied and pasted the language of the independent claims in their entirety. Ex. 1002 at 126-129. In response, the applicant canceled claims 11-14. Ex. 1002 at 136-144. The examiner subsequently issued a Notice of Allowance on July 13, 2005. Ex. 1002 at 147-150. Based on my review of the record, it appears that some of the more pertinent references I listed above (and which I analyze below) were never cited in any office action by the examiner during prosecution.

46. As explained in detail below, based upon my knowledge and experience in this field and my review of the publications cited here, I do not agree that claims 4 and 6 of the '334 patent are patentable over the prior art. The Weiland reference (Ex. 1004), for example, does in fact provide a straightforward teaching of “controlling a gain of said variable amplitude amplifier and a bias condition of said power amplifier using a function defining a relation between bias data and gain data stored in said memory.” Ex. 1004 at 4:14-22, 2:23-41, 4:35-43, FIG. 2. Furthermore, when Weiland is considered in view of the traditional practices of performing open-loop power control at first and then closed-loop power control and controlling a radiotelephone’s transmission power by gradually increasing the power level from an initial low power level to a maximum power level, as described for example in the Dent reference (Ex. 1005), the predictable combination would have provided for a method that includes every element of

independent claim 4.

VII. OVERVIEW OF CONCLUSIONS FORMED AND PRIOR ART REFERENCES

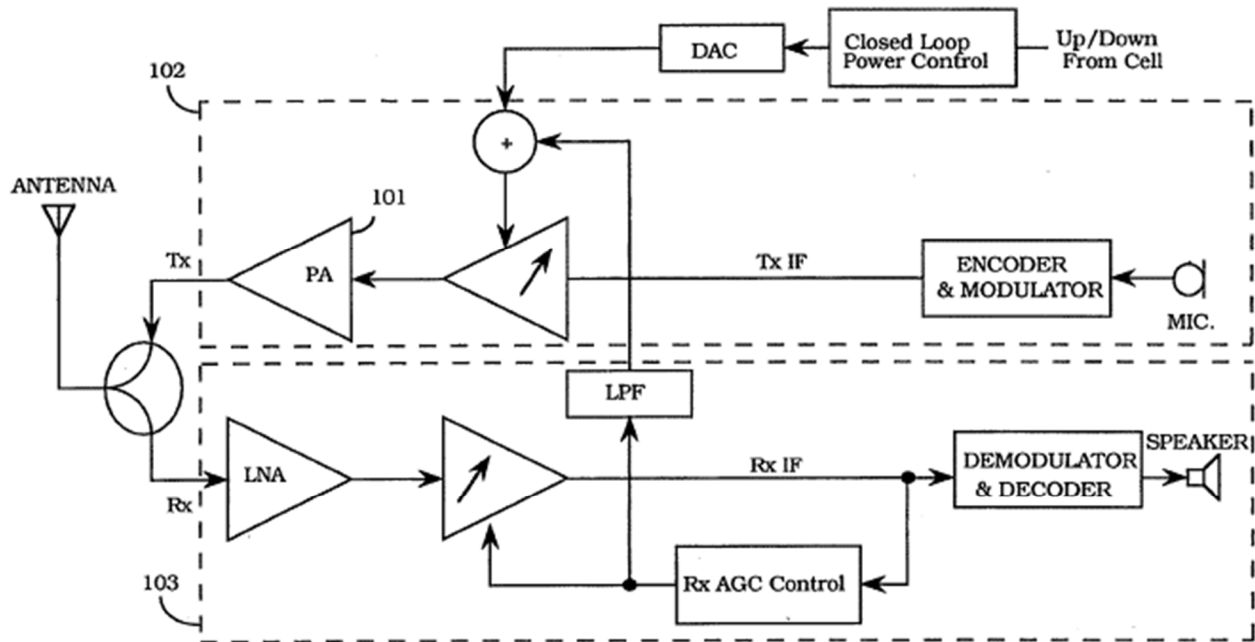
47. This Declaration explains the conclusions that I have formed based on my independent analysis. To summarize those conclusions:

- Based upon my knowledge and experience, and my review of the prior art publications listed above, I believe that claims 4 and 6 of the '334 patent are obvious in light of U.S. Patent 5,452,473 to Weiland et al. ("Weiland") in view of U.S. Patent 5,430,760 to Dent ("Dent").
- Based upon my knowledge and experience, and my review of the prior art publications listed above, I believe that claims 4 and 6 of the '334 patent are obvious in light of U.S. Patent 5,752,172 to Matero ("Matero") in view of U.S. Patent 5,841,768 to Ozluturk et al. ("Ozluturk") and U.S. Patent 5,589,796 to Alberth, Jr. et al. ("Alberth").

VIII. ANALYSIS OF WEILAND IN VIEW OF DENT

48. For the reasons articulated in detail below, and based on my review of the '334 patent, file history, and the prior art references cited here, it is clear that a POSITA would have readily understood that the teachings of Weiland in view of Dent provides all the elements of claims 4 and 6.

49. Similar to the '334 patent, Weiland relates to power control in a radiotelephone system. Ex. 1004 at 1:9-10. Weiland discloses a typical cellular radiotelephone that can be used with CDMA, which is shown in FIG. 1. Ex. 1004 at 1:51-2:15.



- Prior Art -

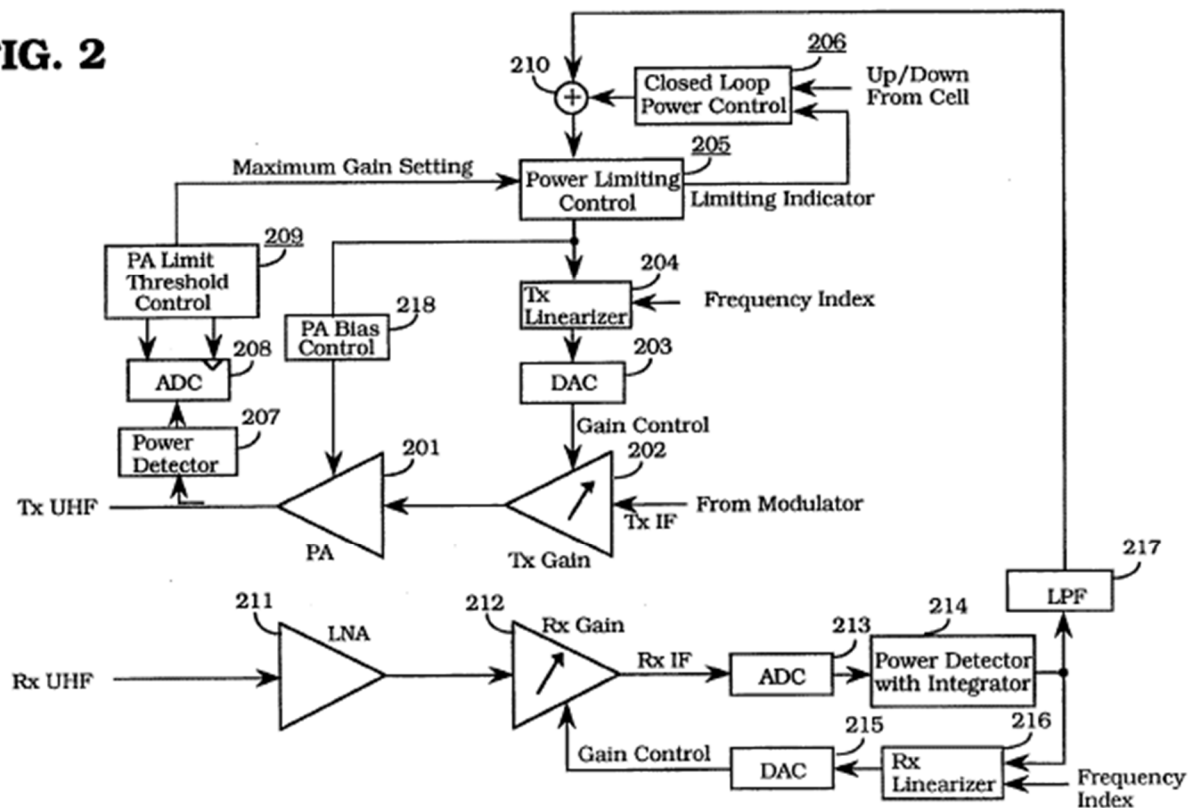
FIG. 1

Ex. 1004 at FIG. 1. Weiland's radiotelephone processes communication signals in a similar manner as the '334 patent's cellular telephone. As shown in FIG. 1 reproduced above, the radiotelephone includes an antenna, a receiver 103, and a transmitter 102. *Id.* The antenna transmits communication signals transferred from the transmitter 102 and provides received communication signals to the receiver 103. *Id.* The receiver 103 includes a demodulator & decoder that demodulates a communication signal, converts the demodulated signal into a voice

code signal, converts the voice code signal to an audio signal, and provides the audio signal to a speaker. *Id.* A microphone provides an audio signal to an encoder & modulator, which converts the audio signal to a voice code signal and modulates the voice code signal into a communication signal. *Id.*

50. FIG. 2 shows the power control components of Weiland's CDMA radiotelephone. Ex. 1004 at 3:11-13.

FIG. 2

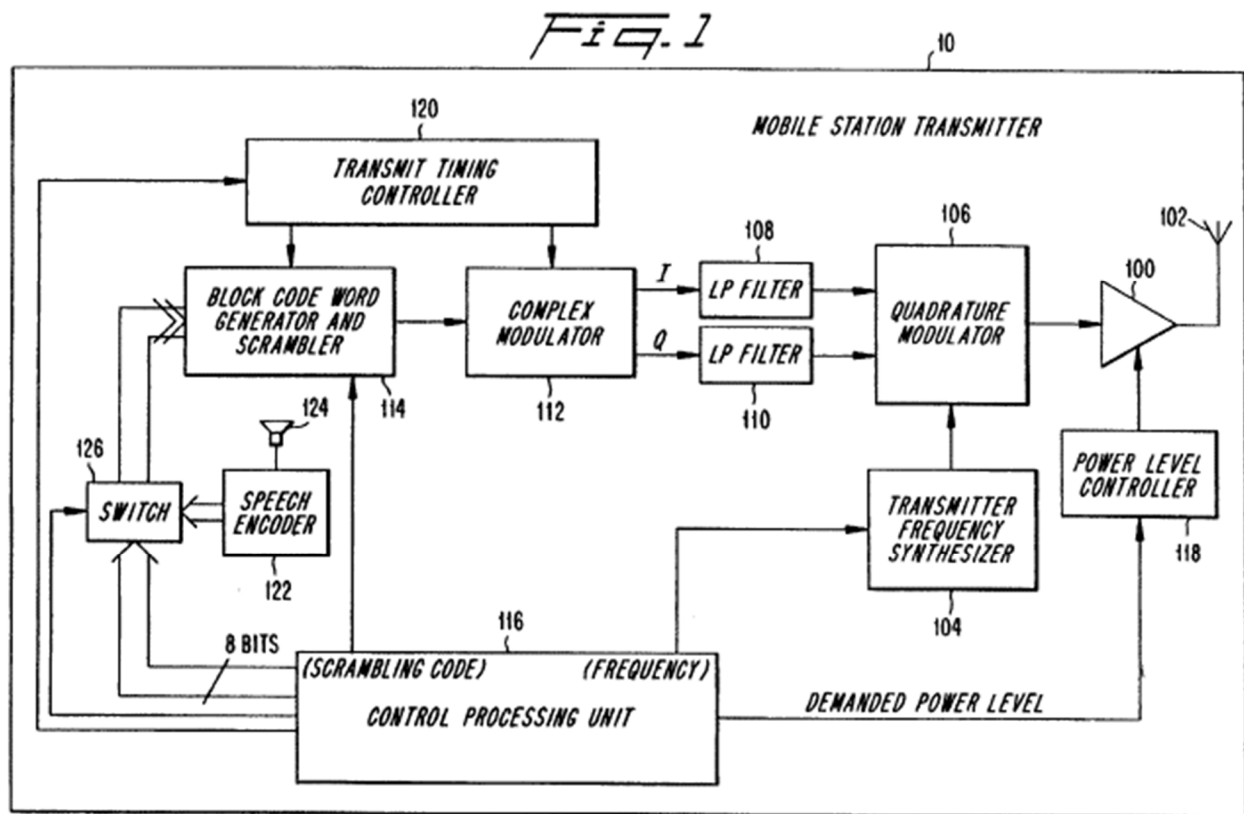


Ex. 1004 at FIG. 2. Weiland discloses, that instead of using a single threshold value as identified by the '334 patent as a problem with prior art systems (Ex. 1001 at 1:41-47), it uses “values stored in a transmitter linearizing table” so the RF output power follows a predetermined straight line. Ex. 1004 at 4:14-29. Weiland

also discloses that the radiotelephone uses open loop power control and closed loop power control to index a set of correction tables that indicate the desired power amplifier biasing for a particular operating point. Ex. 1004 at 2:27-35, 3:66-4:13, 5:24-32. The radiotelephone also prevents the transmitter from operating above a maximum set point. Ex. 1004 at 2:35-37, 4:44-5:23, 5:33-7:7, FIGS. 3, 6-9. The transmit gain and power amplifier biasing of the radiotelephone are adjusted to maintain the desired output power. Ex. 1004 at 2:38-41.

51. Dent also relates to power control in a mobile station operating in a CDMA system. Ex. 1005 at 2:52-3:30, 3:57-68, 4:23-33. In particular, Dent describes power control in a mobile station during initiation and termination of communication with a fixed base station. Ex. 1005, 1:10-13, 2:52-3:68.

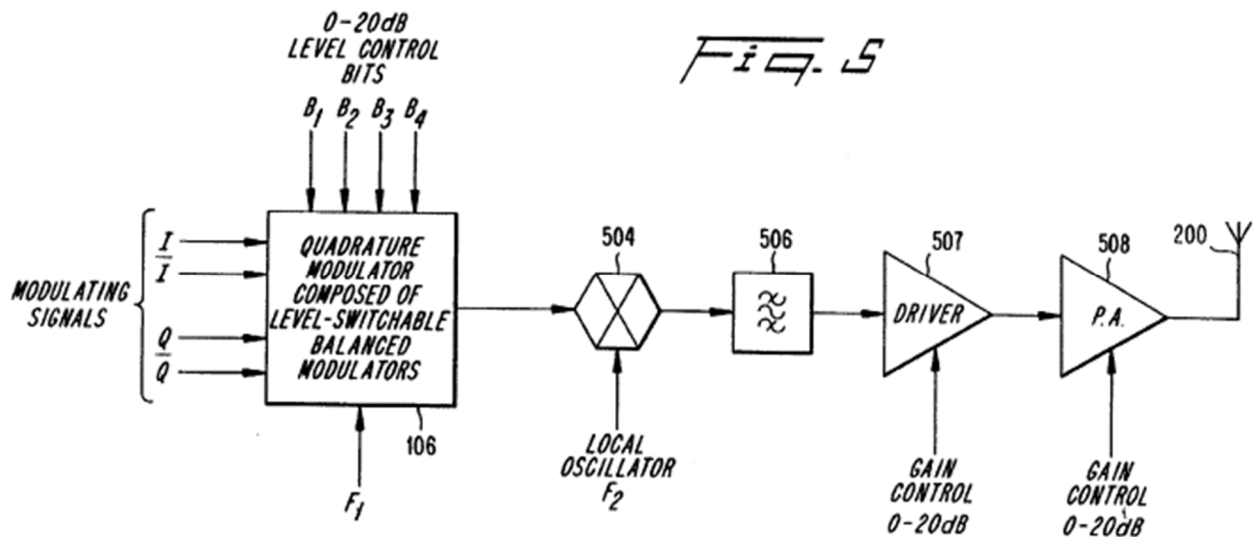
52. Dent discloses a typical mobile station transmitter, which is shown in FIG. 1.



Ex. 1005 at FIG. 1. The transmitter includes modulators 112 and 106 that modulate an information signal, e.g., speech, into a communication signal that is transmitted by antenna 102. Ex. 1005 at 4:58-5:12. The digital information signals received by the modulator 112 are produced by either a block codeword generator and scrambler 114 or a speech encoder 122. Ex. 1005 at 5:13-16. When the mobile station is transmitting a random access message, e.g., before speech communication begins, the message is generated in the control processing unit 166 and input to the block codeword generator and scrambler 114. Ex. 1005 at 5:16-20. For speech transmission, the speech encoder 122 receives a microphone signal from a microphone 124 and provides eight bit inputs to the block codeword

generator and scrambler 114. Ex. 1005 at 5:20-25.

53. The transmitter includes a power level controller 118 that controls the bias of a power amplifier 100 to achieve the desired power level when transmitting each codeword. Ex. 1005 at 5:49-58. The power amplifier 100 can be a multi-stage power amplifier, which is shown in FIG. 5. Ex. 1005 at 5:59-6:4.



Ex. 1005 at FIG. 5. The multi-stage power amplifier includes a driver 507

(variable amplitude amplifier) and a power amplifier 508. Ex. 1005 at 6:30-39.

The power level controller 118 controls the gain of the driver 507 and the gain of the power amplifier 508. *Id.*

54. The power controller 118 sets the power level of an initial random access message from the mobile station at a low power level. Ex. 1005 at 8:1-3, 13:9-21. The power controller 118 gradually increases the transmission power in small increments, e.g., 0.1 dB, after each successive codeword is transmitted. Ex.

1005 at 8:3-6, 13:22-47. The power controller 118 increases the power level according to a ramp function with the ramp slope determining the magnitude of the power increase increment. Ex. 1005 at 8:8-11. Each successive transmission of the random access message by the mobile station occurs at a power level greater than the preceding access message transmission until the base station detects the access message and transmits a reply message to the mobile station. Ex. 1005 at 8:13-18, 10:36-44. Once the mobile station receives the reply message, the mobile station continues to gradually ramp its power until it hits the target value received from the base station. Ex. 1005 at 8:18-23, 12:7-16, 13:48-14:19. Once the base station is satisfied with the transmission power level of the mobile station, the base station indicates to the mobile station that the random access has been accomplished. Ex. 1005 at 16:5-12. The mobile station switches to the code/frequency parameters indicated by the base station, and a closed-loop control of timing and power level is formed between the mobile station and the base station. Ex. 1005 at 16:14-19.

55. Weiland and Dent describe power control of CDMA radiotelephones, and there were a number of reasons that would have prompted a POSITA to predictably apply the teachings of Dent to the radiotelephone of Weiland (as described in detail below). Based on the multiple reasons articulated below, a POSITA would have been prompted to modify the radiotelephone provided by

Weiland to provide the conventional features suggested by Dent to achieve known benefits and as a matter of predictable and routine engineering design, especially by the relatively late time frame leading up to November 1998. As part of my analysis, I will address each of the elements of claims 4 and 6, as follows.

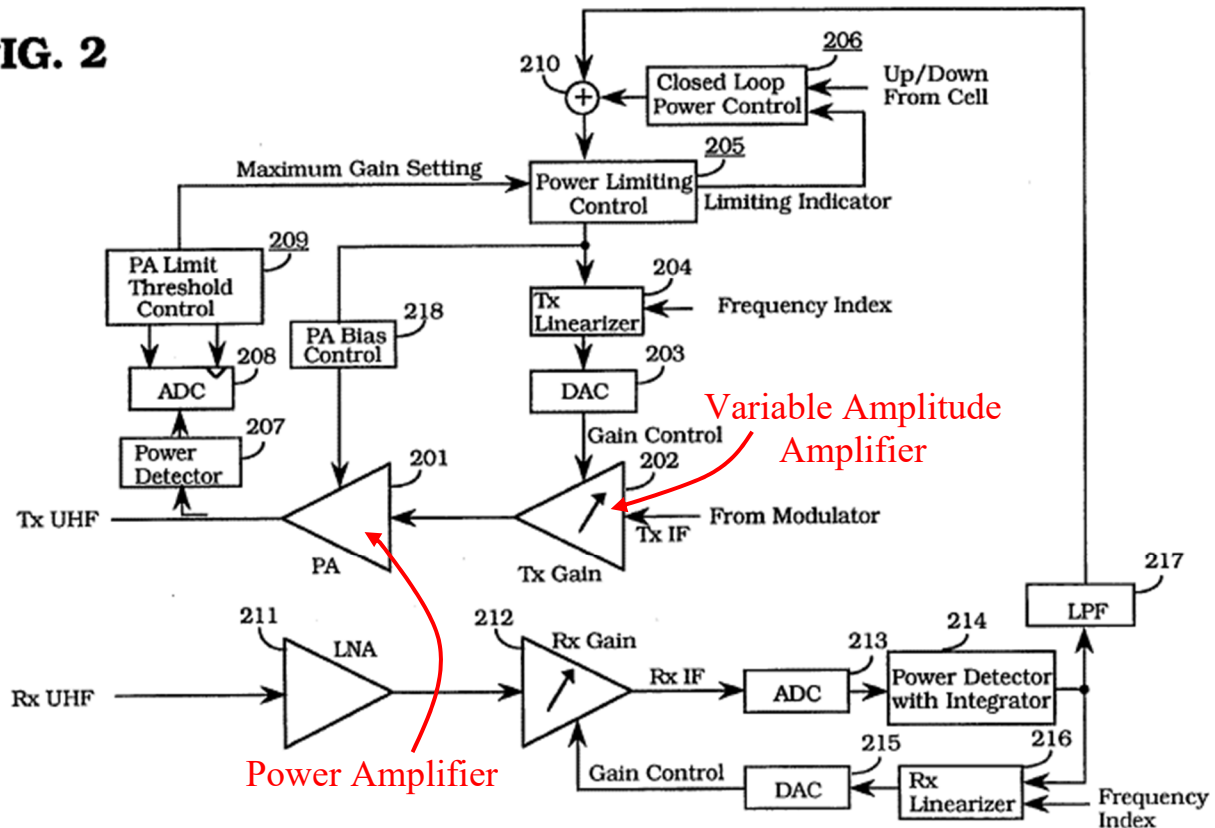
[4.P] A method of controlling a cellular telephone used in a CDMA system, said cellular telephone including a transmitter having a variable amplitude amplifier and a power amplifier, said method comprising the steps of:

56. Weiland describes a method of controlling a cellular telephone used in a CDMA system. For example, Weiland discloses the following:

The process of the present invention provides power control correction for a mobile radiotelephone as well as maintaining acceptable in and out of band maximum emission levels. This is accomplished by real-time compensation utilizing a set of correction tables that are generated during the production testing of each radiotelephone. FIG. 2 shows a block diagram of a CDMA radiotelephone with the preferred embodiment power control correction implementation.

Ex. 1004 at 3:4-13 (emphasis added). Weiland also discloses that the cellular telephone includes a transmitter having a variable amplitude amplifier and a power amplifier. For example, Weiland discloses that “FIG. 2 shows a block diagram of a CDMA radiotelephone.” Ex. 1004 at 3:11-13. FIG. 2 (reproduced below) shows that the cellular radiotelephone includes a variable gain amplifier 202 and a transmit power amplifier 201. Ex. 1004 at 4:19-43.

FIG. 2

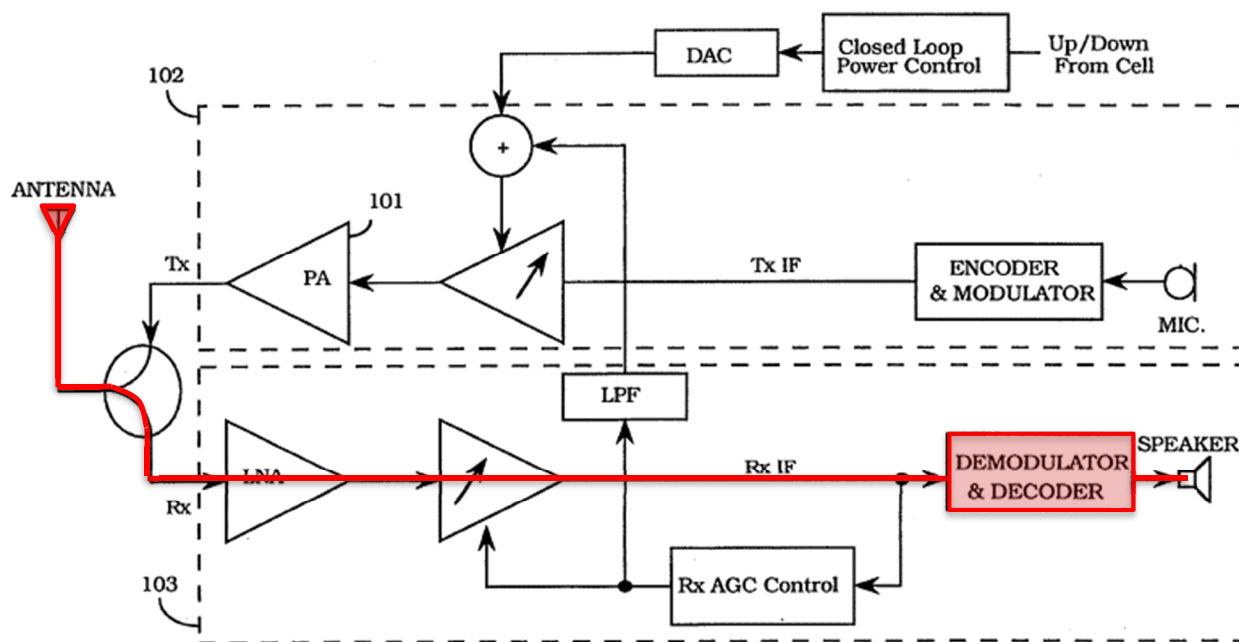


Ex. 1004 at FIG. 2 (annotated). Weiland's variable gain amplifier 202 corresponds to the claimed variable amplitude amplifier because Weiland's variable gain amplifier 202 is a variable amplitude amplifier and is at the same location (the input to the Power Amplifier) in the transmitter circuit as the claimed variable amplitude amplifier. Weiland's transmit power amplifier 201 corresponds to the claimed a power amplifier.

[4.1] receiving a first communication signal and a transmitting power control signal from a cell-site station,

57. Weiland describes receiving a first communication signal and a transmitting power control signal from a cell-site station. For example, Weiland is directed to a radiotelephone and discloses that "FIG. 1 shows a typical prior

cellular radiotelephone.” Ex. 1004 at 1:51, 2:23-27. FIG. 1 (reproduced below) shows that the cellular radiotelephone includes an antenna coupled with a demodulator and decoder that provides a signal to a speaker.



- Prior Art -

FIG. 1

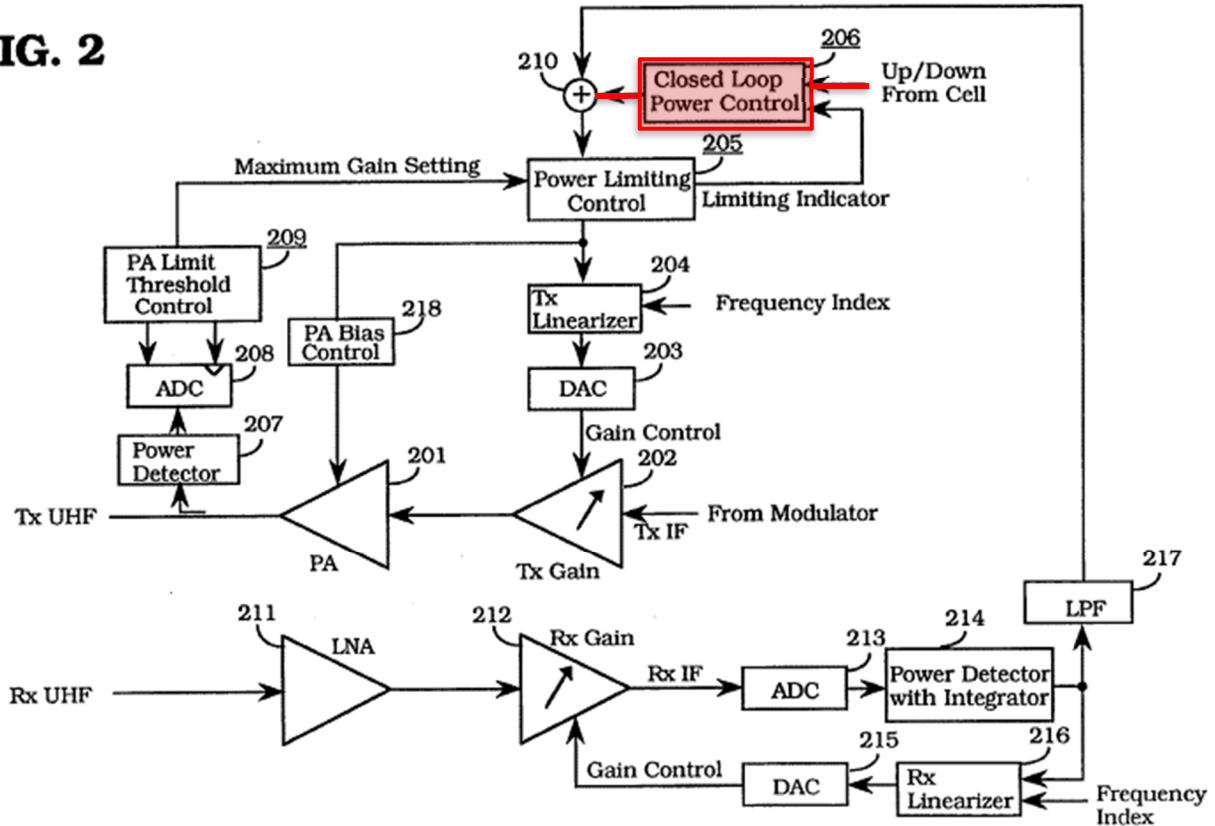
Ex. 1004 at FIG. 1 (annotated). A POSITA would have recognized that the antenna receives a communication signal from a cell site.

58. Weiland also discloses receiving a transmitting power control signal from a cell-site station as follows:

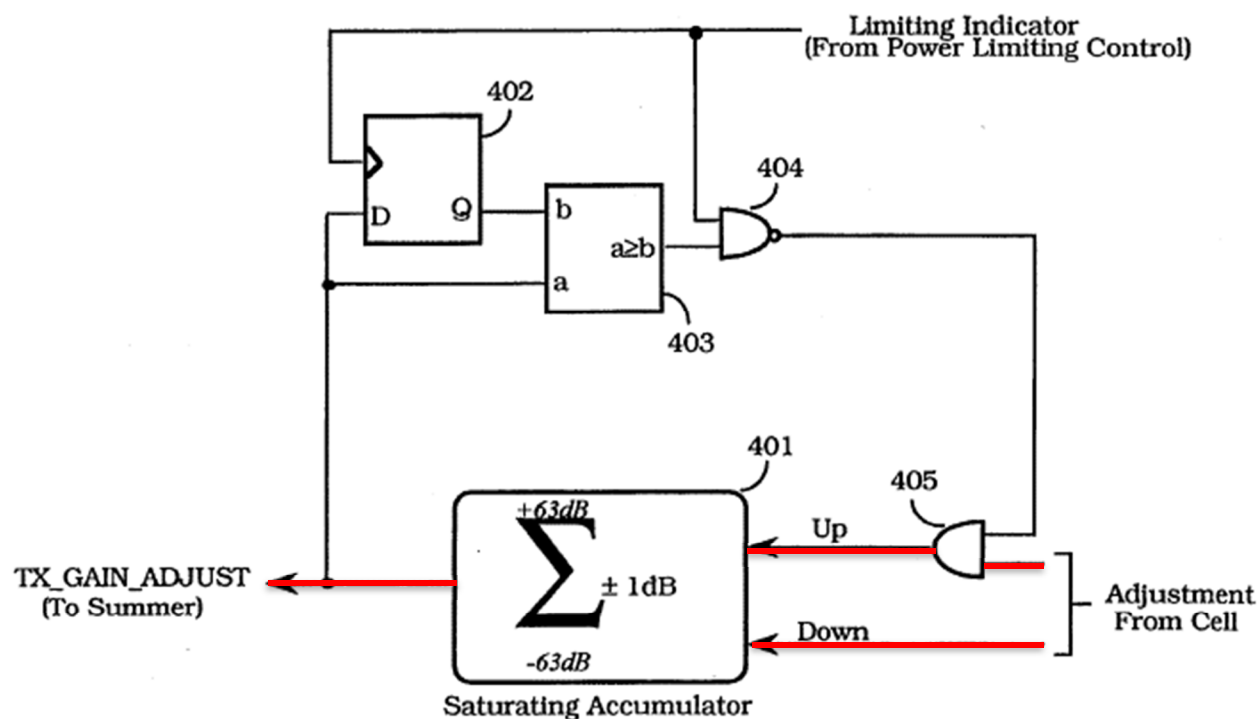
The closed loop power control section (206), illustrated in FIG. 4, accumulates the power control commands sent on the forward link by the controlling radiotelephone cell site and outputs a gain adjust signal. The power control commands are collected in an accumulator (401). The operation of the accumulator (401) is controlled by the power

Ex. 1004 at 5:24-32 (emphasis added). I have highlighted the above-described closed-loop power control in FIG. 2:

FIG. 2



Ex. 1004 at FIG. 2 (annotated). FIG. 4 shows a block diagram of the closed-loop power control section:



206
FIG. 4

Ex. 1004 at FIG. 4 (annotated), 2:51-52. Based on Weiland's disclosures, Weiland's closed-loop power control section receives a transmitting power control signal from a cell-site station.

[4.2] generating a power control signal derived from said transmitting power control signal received from said cell-site station,

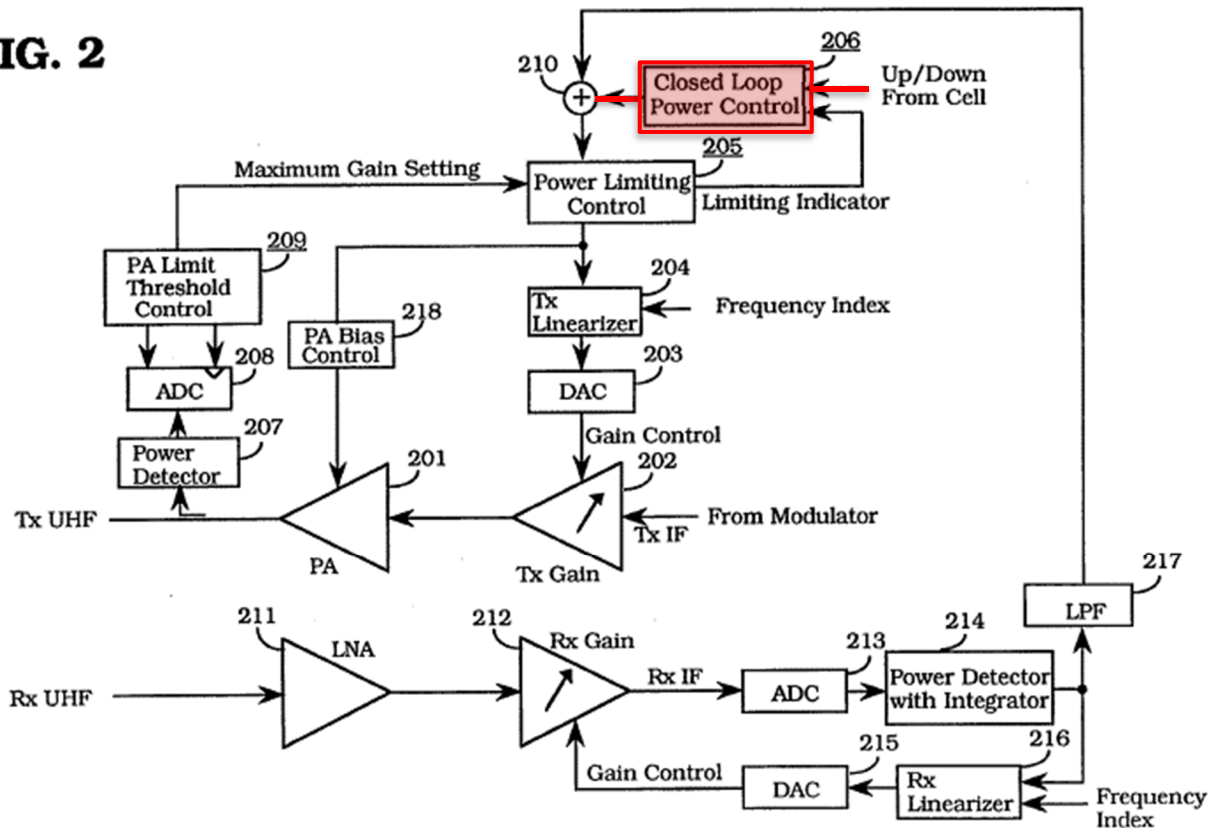
59. Weiland describes generating a power control signal derived from the transmitting power control signal received from the cell-site station. For example, Weiland discloses the following:

The closed loop power control section (206), illustrated in FIG. 4, accumulates the power control commands sent on the forward link by

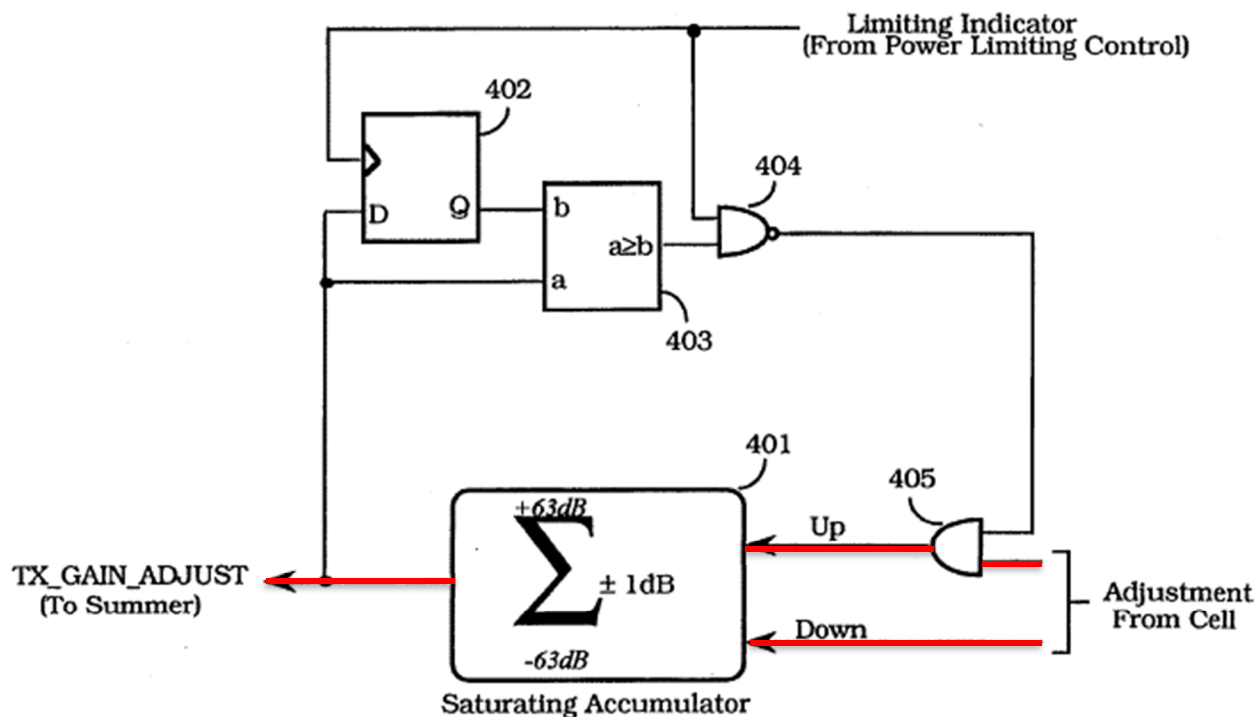
the controlling radiotelephone cell site and outputs a gain adjust signal. The power control commands are collected in an accumulator (401). The operation of the accumulator (401) is controlled by the power control limiting section (205) when the transmit power amplifier (201) is outputting the maximum allowable power.

Ex. 1004 at 5:24-32 (emphasis added). I have highlighted the above-described closed-loop power control in FIG. 2:

FIG. 2



Ex. 1004 at FIG. 2 (annotated). FIG. 4 shows a block diagram of the closed-loop power control section:



206

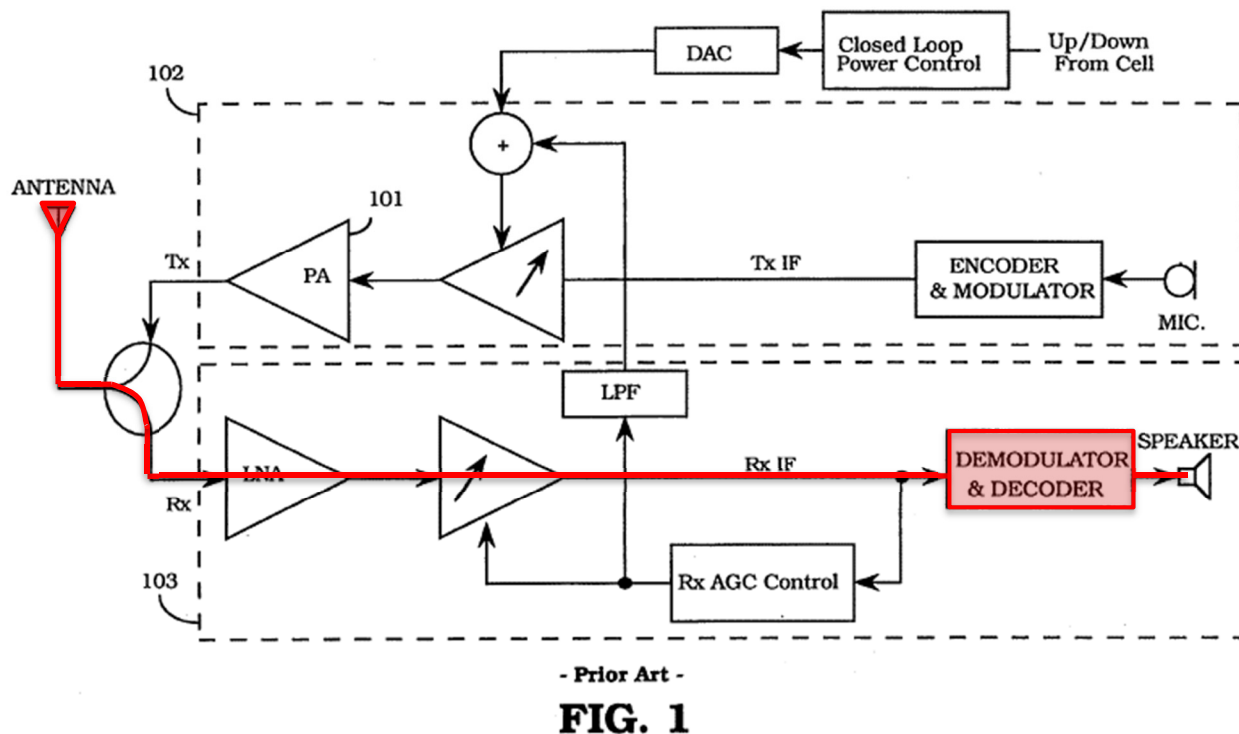
FIG. 4

Ex. 1004 at FIG. 4 (annotated), 2:51-52. Based on Weiland's disclosures, Weiland's closed-loop power control section receives a transmitting power control signal from a cell-site station and generates a power control signal derived from the transmitting power control signal received from the cell-site station.

[4.3] converting said first communication signal received from a cell-site station into a voice signal code,

60. Weiland describes converting the first communication signal received from the cell-site station into a voice signal code. For example, Weiland discloses that "FIG. 1 shows a typical prior cellular radiotelephone." Ex. 1004 at 1:51. FIG. 1 (reproduced below) shows that the cellular radiotelephone includes an antenna

coupled with a demodulator and decoder that provides a signal to a speaker.



Ex. 1004 at FIG. 1 (annotated). A POSITA would have recognized that the demodulator and decoder converts the received communication signal into a voice signal code and converts the voice signal code into an audio signal for driving an acoustic transducer (e.g., speaker) of the cellular radiotelephone. In this respect, Weiland is much like the '334 patent. The '334 patent also describes the receiver 100 including demodulators that demodulate the communication signal and convert the demodulated signal into a voice code signal, which is converted to an audio signal by an encoder/decoder apparatus and provided to a speaker. Ex. 1001 at 4:49-60, 5:1-13.

[4.4] converting said voice signal code into an audio signal for driving an acoustic transducer of said cellular telephone,

61. Weiland describes converting the voice signal code into an audio signal for driving an acoustic transducer of the cellular telephone. For example, Weiland discloses that “FIG. 1 shows a typical prior cellular radiotelephone.” Ex. 1004 at 1:51. FIG. 1 (reproduced below) shows that the cellular radiotelephone includes an antenna coupled with a demodulator and decoder that provides a signal to a speaker.

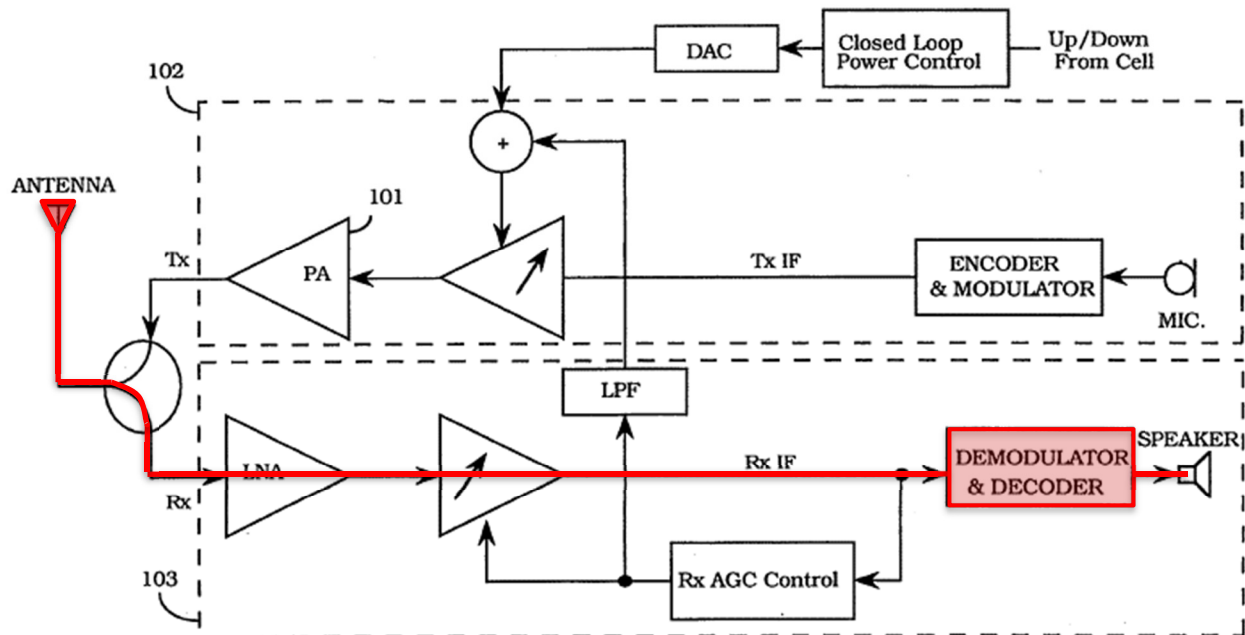


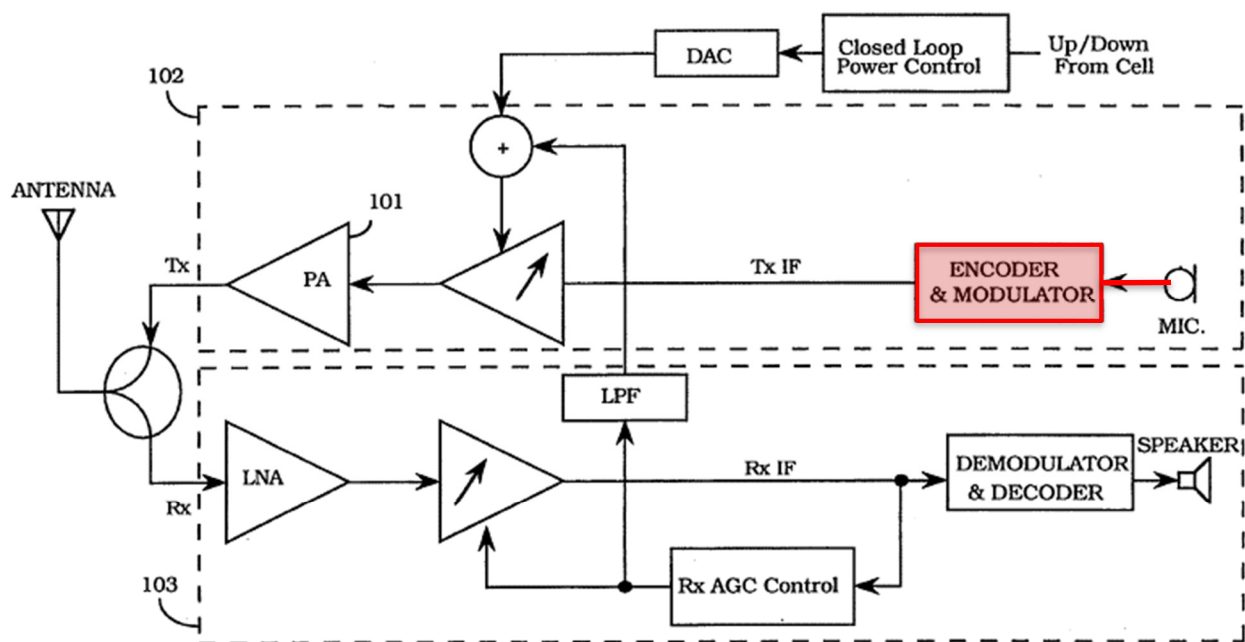
FIG. 1

Ex. 1004 at FIG. 1 (annotated). A POSITA would have recognized that the demodulator and decoder converts the received communication signal into a voice signal code and converts the voice signal code into an audio signal for driving an acoustic transducer (e.g., speaker) of the cellular radiotelephone. In this respect,

Weiland is much like the '334 patent. The '334 patent also describes the receiver 100 including demodulators that demodulate the communication signal and convert the demodulated signal into a voice code signal, which is converted to an audio signal by an encoder/decoder apparatus and provided to a speaker. Ex. 1001 at 4:49-60, 5:1-13.

[4.5] converting an audio input signal from said acoustic transducer into an input voice code signal,

62. Weiland describes converting an audio input signal from an acoustic transducer into an input voice code signal. For example, Weiland discloses that “FIG. 1 shows a typical prior cellular radiotelephone.” Ex. 1004 at 1:51. FIG. 1 (reproduced below) shows that the cellular radiotelephone includes an encoder and modulator that receives a signal from a microphone.



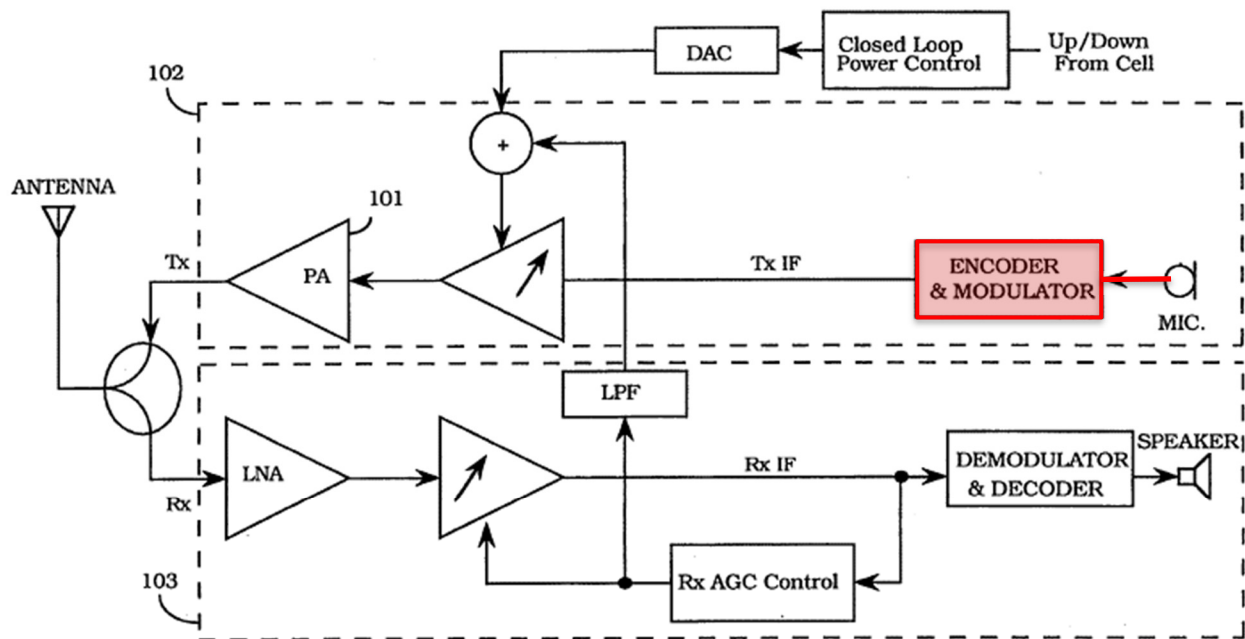
- Prior Art -

FIG. 1

Ex. 1004 at FIG. 1 (annotated). A POSITA would have recognized that the encoder and modulator converts an audio input signal from an acoustic transducer (e.g., microphone) into an input voice code signal and converts the input voice code signal into a communication signal. In this respect, Weiland is much like the '334 patent. The '334 patent discloses that a microphone provides an audio signal to an encoder/decoder apparatus, which converts the audio signal to a voice code signal that is modulated by modulators into a communication signal. Ex. 1001 at 5:14-34.

[4.6] converting said input voice code signal into a second communication signal,

63. Weiland describes converting the input voice code signal into a second communication signal. For example, Weiland discloses that “FIG. 1 shows a typical prior cellular radiotelephone.” Ex. 1004 at 1:51. FIG. 1 (reproduced below) shows that the cellular radiotelephone includes an encoder and modulator that receives a signal from a microphone.



- Prior Art -

FIG. 1

Ex. 1004 at FIG. 1 (annotated). A POSITA would have recognized that the encoder and modulator converts an audio input signal from an acoustic transducer (e.g., microphone) into an input voice code signal and converts the input voice code signal into a communication signal. In this respect, Weiland is much like the '334 patent. The '334 patent discloses that a microphone provides an audio signal to an encoder/decoder apparatus, which converts the audio signal to a voice code signal that is modulated by modulators into a communication signal. Ex. 1001 at 5:14-34.

[4.7] controlling said transmitter in such a manner that an open-loop power control is performed at first and then a closed-loop power control is performed according to said power control signal so as to control transmitted power to converge into a range required by said cell site station, and

64. The combination of Weiland in view of Dent provides controlling the transmitter in such a manner that an open-loop power control is performed at first and then a closed-loop power control is performed according to the power control signal so as to control transmitted power to converge into a range required by the cell site station. For example, Weiland discloses controlling the transmitter in such a manner that an open-loop power control (e.g., control using detected power levels without power adjustment commands from cell site) is performed and a closed-loop power control is performed according to the power control signal (adjustment commands from cell site) so as to control transmitted power to converge into a range required by the cell site station as follows:

The process of the present invention enables a radiotelephone to operate in a linear fashion over a wide dynamic range while maintaining acceptable transmit output power levels inside and outside of the return link bandwidth. The forward and return link power are measured by power detectors and input to an analog to digital converter accessible by both control hardware and/or software. The closed loop power control setting is also monitored. The radiotelephone uses the detected power levels and closed loop power control setting to index a set of correction tables that indicate the reverse link transmit power error and desired power amplifier biasing for the particular operating point. The

radiotelephone also determines if the transmitter is operating above a maximum set point. The transmit gain and power amplifier biasing of the radiotelephone are adjusted to correct the undesired error and maintain the desired output power.

Ex. 1004 at 2:23-41 (emphasis added).

65. Weiland discloses the open-loop power control in more detail as follows:

The power of the digitized received signal is next computed by a digital power detector (214). The power detector (214) includes an integrator that integrates the detected power with respect to a reference voltage. ... The power detector (214) performs the integration, thus generating an AGC setpoint.

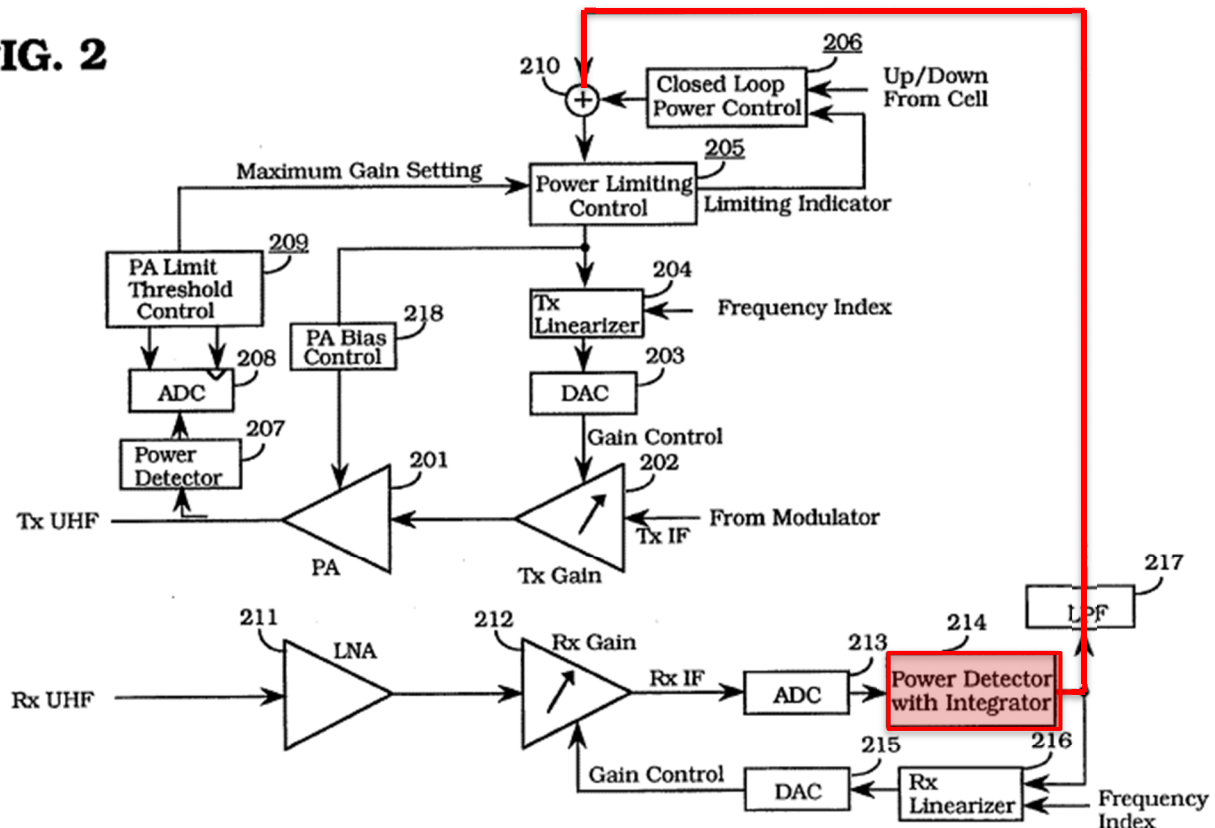
Ex. 1004 at 3:26-38.

The AGC setpoint is the open loop power control signal for the radio. In the preferred embodiment, this is the power control performed by the radio by itself without control input from the cells. As the power of the signal received from the cell increases, the radio decreases its transmit power. This output power control is accomplished by the AGC setpoint that is filtered by a low pass filter (217).

The transmit section includes a digital summer (210) that combines the AGC setpoint and a closed loop power control setting (206). The output of the summer (210) is fed into a power control limiting section (205). The operation of the power control limiting section (205) and the closed loop power control section (206), illustrated in FIGS. 3 and 4 respectively, will be discussed subsequently in greater detail.

Ex. 1004 at 3:66-4:13 (emphasis added). I have highlighted the above-described open-loop power control in FIG. 2:

FIG. 2



Ex. 1004 at FIG. 2 (annotated).

66. Weiland discloses the closed-loop power control in more detail as follows:

The transmit section includes a digital summer (210) that combines the AGC setpoint and a closed loop power control setting (206). The output of the summer (210) is fed into a power control limiting section (205). The operation of the power control limiting section (205) and the closed loop power control section (206), illustrated in FIGS. 3 and 4 respectively, will be discussed subsequently in greater detail.

Ex. 1004 at 4:6-13 (emphasis added).

The closed loop power control section (206), illustrated in FIG. 4, accumulates the power control commands sent on the forward link by the controlling radiotelephone cell site and outputs a gain adjust signal. The power control commands are collected in an accumulator (401). The operation of the accumulator (401) is controlled by the power control limiting section (205) when the transmit power amplifier (201) is outputting the maximum allowable power.

When the output of the summer (210) changes from being less than to equal or greater than the maximum allowable setting, the output of the closed loop power control accumulator (401) is latched into a flip-flop (402). While the output of the summer (210) is equal to or greater than the maximum allowable setting, as determined by the comparator (403) and NAND gate (404) circuit, an AND gate (405) masks off any closed loop power control up commands that would force the accumulator (401) above the flip-flop's (402) latched value. This prevents the accumulator from saturating during power limiting yet allows the closed loop power control setting to change anywhere below the latched value.

Ex. 1004 at 5:24-46 (emphasis added). I have highlighted the above-described closed-loop power control in FIG. 2:

FIG. 2

The diagram illustrates a power limiting system for a transmitter and receiver. The transmitter path (top) starts with a Tx UHF input entering a PA (Power Amplifier) block 201. The PA is controlled by a PA Bias Control block 218 and a PA Limit Threshold Control block 209. The PA output goes to a Tx IF (Intermediate Frequency) block 202, which is also controlled by a Tx Gain block 203. The Tx IF signal then passes through a Tx Linearizer block 204. The output of the Tx Linearizer is fed back to a Closed Loop Power Control block 205, which also receives an Up/Down From Cell signal 206. The Closed Loop Power Control block 205 outputs a signal to a summing junction 210, which also receives a Maximum Gain Setting signal. The output of the summing junction 210 is fed into a Power Limiting Control block 205. The Power Limiting Control block 205 outputs a Limiting Indicator signal 206 and a Frequency Index signal 204. The Frequency Index signal 204 is fed into the Tx Linearizer block 204 and a DAC (Digital-to-Analog Converter) block 203. The DAC 203 outputs a Gain Control signal 202 to the Tx Gain block 203. The receiver path (bottom) starts with an Rx UHF input entering an LNA (Low Noise Amplifier) block 211. The LNA output goes to an Rx Gain block 212, which is controlled by a Gain Control signal 215. The Rx Gain block 212 outputs an Rx IF signal to an ADC (Analog-to-Digital Converter) block 213. The ADC 213 outputs a signal to a Power Detector with Integrator block 214. The Power Detector with Integrator block 214 outputs a signal to a DAC (Digital-to-Analog Converter) block 215. The DAC 215 outputs a Gain Control signal 215 to the Rx Gain block 212. The Power Detector with Integrator block 214 also outputs a Frequency Index signal 216 to an Rx Linearizer block 216. The Rx Linearizer block 216 outputs a signal to a summing junction 217, which also receives a Maximum Gain Setting signal. The output of the summing junction 217 is fed into a Power Limiting Control block 217. The Power Limiting Control block 217 outputs a Limiting Indicator signal 217 and a Frequency Index signal 216. The Frequency Index signal 216 is fed into the Rx Linearizer block 216 and a DAC (Digital-to-Analog Converter) block 215. The DAC 215 outputs a Gain Control signal 215 to the Rx Gain block 212.

46

Ex. 1004 at FIG. 4 (annotated). As shown in FIGS. 2 and 4, the closed-loop power control is performed according to the power control signal (e.g., TX_GAIN_ADJUST signal) derived from the transmitting power control signal received from the cell site station (e.g., power control commands sent on the forward link by the controlling radiotelephone cell site).

67. To the extent that Weiland's teachings of open-loop power control and closed-loop power control are considered to not explicitly disclose that the open-loop power control is performed at first and then the closed-loop power control is performed, such a feature was commonly known in similar prior art methods of controlling a cellular telephone. The '334 patent acknowledges that this feature is present in the prior art IS-95 standard for the CDMA cellular telephone system. Ex. 1001 at 1:26-27, 1:47-61. In particular, the '334 patent discloses that "[i]n IS-95, open-loop power control and closed-loop power control are employed in order to regulate a receiving power at the cell-site station" and "the transmitter performs the open-loop power control at first, then it performs the closed-loop power control for the transmitted power to converge into a desired value which the cell-site station requires." Ex. 1001 at 1:47-61. Indeed, this feature is described in only the "Description of the Related Art" section of the '334 patent.

68. In addition, Dent describes a prior art method that includes controlling

a mobile station's transmission power level for performing random access. Ex. 1005 at 1:15-23, 2:52-3:30. Dent discloses that, for random access, the mobile station performs open-loop power control first and then closed-loop power control as follows:

The power level of the initial random access message from the mobile station 10 is set by the power controller 118 at a low power level. The power controller 118 gradually increases the transmission power in small increments, e.g., 0.1 dB, after each successive codeword is transmitted. These successive power increases continue for the total number of codewords making up the random access message. Preferably, the power level increases according to a ramp function with the ramp slope determining the magnitude of the power increase increment. A ramp function is readily implemented and simplifies the signal strength prediction process of the base station signal tracker and sorter 210. Each successive transmission of the random access message by the mobile station 10 occurs at a power level greater than the preceding access message transmission until the base station 20 detects the access message and transmits a reply message to the mobile station 10. Once that reply message is received and the base station 20 indicates that the mobile power level is in the desired signal strength range, the mobile station 10 fixes its transmitted power at a level specified by the base station 20 in the reply message.

Ex. 1005 at 8:1-23 (emphasis added), *see also* 2:52-3:30, 12:7-16, 13:48-14:19.

Once the base station 20 is satisfied with the power level and time-alignment, it sends a “traffic channel allocation” message to the mobile

station 10. The traffic channel allocation message indicates to the mobile station 10 that the random access has been accomplished and that the mobile station 10 may proceed to the next stage of call set-up. For mobile initiated call set-ups, the mobile station 10 transmits the telephone number of the party being called. When the traffic channel allocation message is sent to the mobile station 10, the mobile station 10 switches to the code/frequency parameters indicated in the message. Thus, a closed-loop control of timing and power level is formed between the mobile station 10 and the base station 20. Preferably, the power level control loop functions in accordance with the system described in a pending application “Duplex Power Control,” U.S. patent application Ser. No. 07/866,554, filed on Apr. 10, 1992, and incorporated above by reference.

Ex. 1005 at 16:5-23 (emphasis added). Based on my knowledge and experience in this field and my review of Weiland and Dent, a POSITA would have recognized that increasing the transmission power in small increments according to a ramp function prior to receiving the reply message from the base station is an example of open-loop power control because, according to Weiland, open-loop power control is “the power control performed by the radio by itself without control input from the cells.” Ex. 1004 at 3:66-4:1. Thus, Dent teaches that the mobile station performs open-loop power control at first when it is attempting to access the cell site and then closed-loop power control to control transmitted power to converge into a range required by the cell site station after the initial access is successful.

69. The combination of Weiland and Dent would result in Weiland's method for controlling the transmitter including Dent's suggestion for performing open-loop power control at first and then closed-loop power control for random access. Applying Dent's teachings to Weiland's system would have led to Weiland's system performing open-loop power control for a random access call set-up, which includes gradually increasing the bias condition of the power amplifier using the set of correction tables and the ramp function until a connection to a base station is made. Based on my knowledge and experience in this field and my review of Weiland and Dent, it would have been obvious to a POSITA to combine Weiland with Dent to include, in Weiland's method for controlling the transmitter, Dent's suggestion for performing open-loop power control at first and then closed-loop power control for random access. Multiple reasons confirm this analysis. *See, infra*, ¶¶71-74.

70. A POSITA would have predictably achieved this result with a reasonable expectation of success. Weiland discloses a CDMA radiotelephone including a transmitter having a variable gain amplifier and a power amplifier. Ex. 1004 at 3:11-13, 4:19-43, FIG. 2. Similarly, Dent discloses a CDMA mobile station including a transmitter having a variable gain amplifier (e.g., driver 507) and a power amplifier. Ex. 1005 at 4:23-27, 5:49-6:39, FIG. 5. Weiland discloses controlling the transmitter's power by controlling the gain of the variable gain

amplifier and controlling the bias of the power amplifier. Ex. 1004 at 4:14-43, FIG. 2. Similarly, Dent discloses controlling the transmitter's power by controlling the gain of the variable gain amplifier and controlling the bias of the power amplifier. Ex. 1005 at 5:49-6:39, FIG. 5.

71. Based on my knowledge and experience in this field, a number of reasons would have motivated a POSITA to implement Dent's suggestion for performing open-loop power control at first and then closed-loop power control for random access. A POSITA would have recognized the benefits of Dent's suggestion and would have been motivated to achieve these benefits of Dent in Weiland.

72. As a first reason, a POSITA would have recognized that a radiotelephone should ensure that the radiated emissions are maintained within acceptable levels to avoid interfering with other radiotelephones, as stated by Weiland (Ex. 1004 at 1:15-21) and Dent (Ex. 1005 at 2:40-46), and controlling a radiotelephone's transmission power by gradually increasing the power level from an initial low power level (e.g., open-loop power control) until a reply message is received from a base station (e.g., closed-loop power control) provides the benefit of minimizing the interference caused by radio communications initiated between a radiotelephone and a base station, as stated by Dent (Ex. 1005 at 1:10-13, 2:52-65, 4:28-33, 7:57-68, 8:34-37). A POSITA would have been motivated to achieve

these benefits in Weiland by controlling Weiland's already present variable gain amplifier and power amplifier to control the transmitter's power for random access as suggested by Dent.

73. As a second reason, a POSITA would have been motivated to combine Weiland's method with Dent's suggestion for gradually increasing the power level according to a ramp function for random access. Doing so would advantageously allow a base station communicating with Weiland's radiotelephone to detect random access messages transmitted at a power level too low to interfere with ongoing traffic, decode every codeword after detecting a random access attempt, track small changes of power level between codewords, and provide the radiotelephone with consistent instructions for the radiotelephone to more accurately control the time advance and power level of the transmitter, as suggested by Dent. Ex. 1005 at 9:3-21, 13:9-14:38.

74. As a third reason, a POSITA would have been prompted to incorporate Dent's suggestion with Weiland's system because doing so would have been a common application of a known technique (e.g., Dent's suggestion for performing open-loop power control at first and then closed-loop power control for random access) to a known system (e.g., Weiland's radiotelephone) ready for improvement to yield predictable results. As discussed above, both Weiland and Dent disclose power control of CDMA mobile telephones. Based upon my

knowledge and experience in this field and my review of Weiland and Dent, it is clear that a POSITA would have recognized that applying Dent's teachings to Weiland's radiotelephone would have led to predictable results, with Weiland's radiotelephone including Dent's suggestion for performing open-loop power control at first and then closed-loop power control for random access. This implementation (applying Dent's teachings to Weiland's radiotelephone) would not have significantly altered or hindered the functions performed by Weiland's radiotelephone, and it would have been a relatively straightforward and ordinary task for a POSITA (certainly by the relatively late time frame leading up to November 1998).

[4.8] controlling a gain of said variable amplitude amplifier and a bias condition of said power amplifier using a function defining a relation between bias data and gain data stored in said memory,

75. Weiland describes controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in a memory. For example, Weiland discloses controlling the gain of the variable amplitude amplifier (Weiland's variable gain amplifier) using gain data stored in a memory as follows:

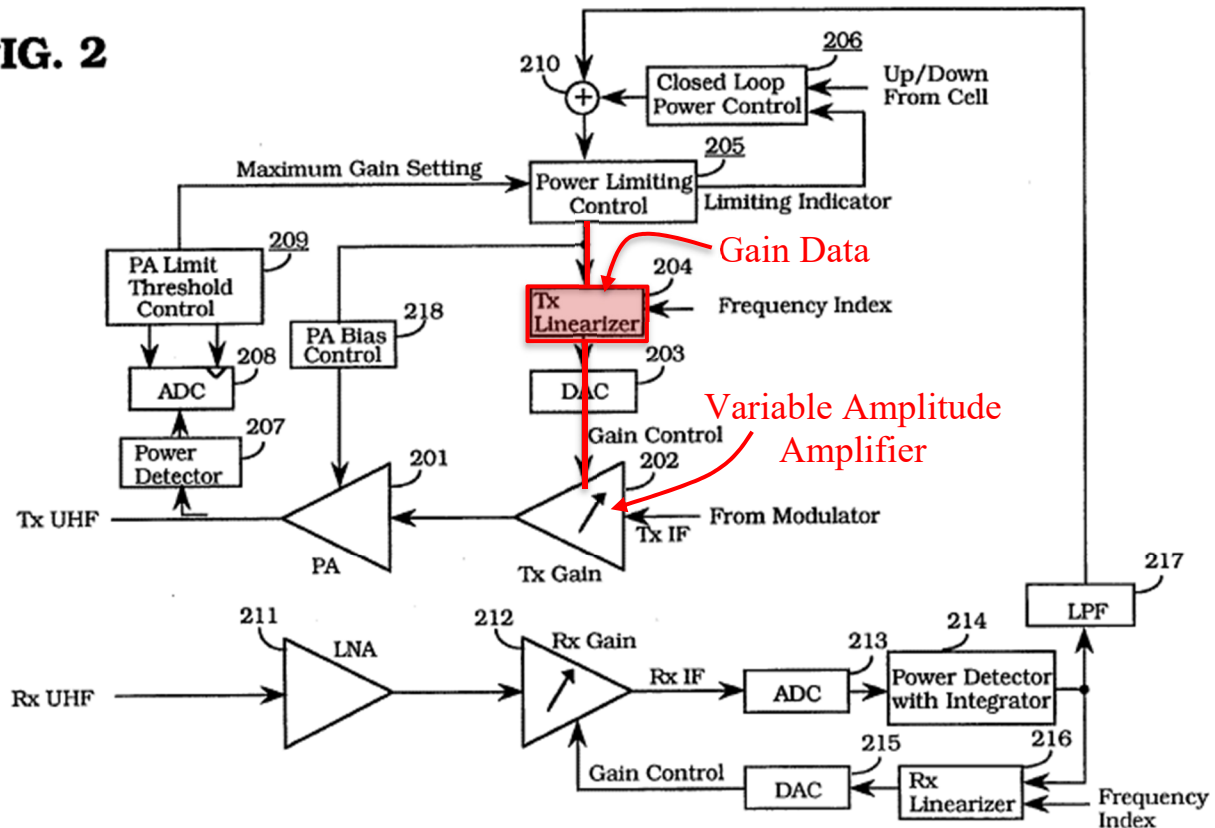
The output of the power control limiting section (205), along with the transmit frequency index, are used to address values stored in a transmitter linearizing table (204). The transmitter linearizing table (204) contains values determined from production testing of the

radiotelephone. The selected value is input to a digital to analog converter (203) whose output, an analog representation of the digital value input, controls a variable gain amplifier (202).

The biasing of the variable gain amplifier (202) is adjusted by the analog calibration value to a point such that the input to the transmitter linearizing table (204) follows a predetermined straight line with respect to transmitted RF output power. This linearization removes the undesired linear and non-linear errors along with variations versus frequency in the transmitter. This, combined with the previously mentioned receive linearization, greatly reduces the open and closed loop power control errors due to RF performance imperfections.

Ex. 1004 at 4:14-34 (emphasis added). I have highlighted the control of the gain of the variable gain amplifier 202 using values stored in the table 204 in FIG. 2 below:

FIG. 2



Ex. 1004 at FIG. 2 (annotated). A POSITA would have recognized that the table 204 includes gain data, e.g., values for adjusting the variable gain amplifier, and is a type of data structure stored in a memory.

76. Weiland discloses controlling a bias condition of the power amplifier using bias data stored in a memory as follows:

The process of the present invention enables a radiotelephone to operate in a linear fashion over a wide dynamic range while maintaining acceptable transmit output power levels inside and outside of the return link bandwidth. The forward and return link power are measured by power detectors and input to an analog to digital converter accessible by both control hardware and/or software. The closed loop power

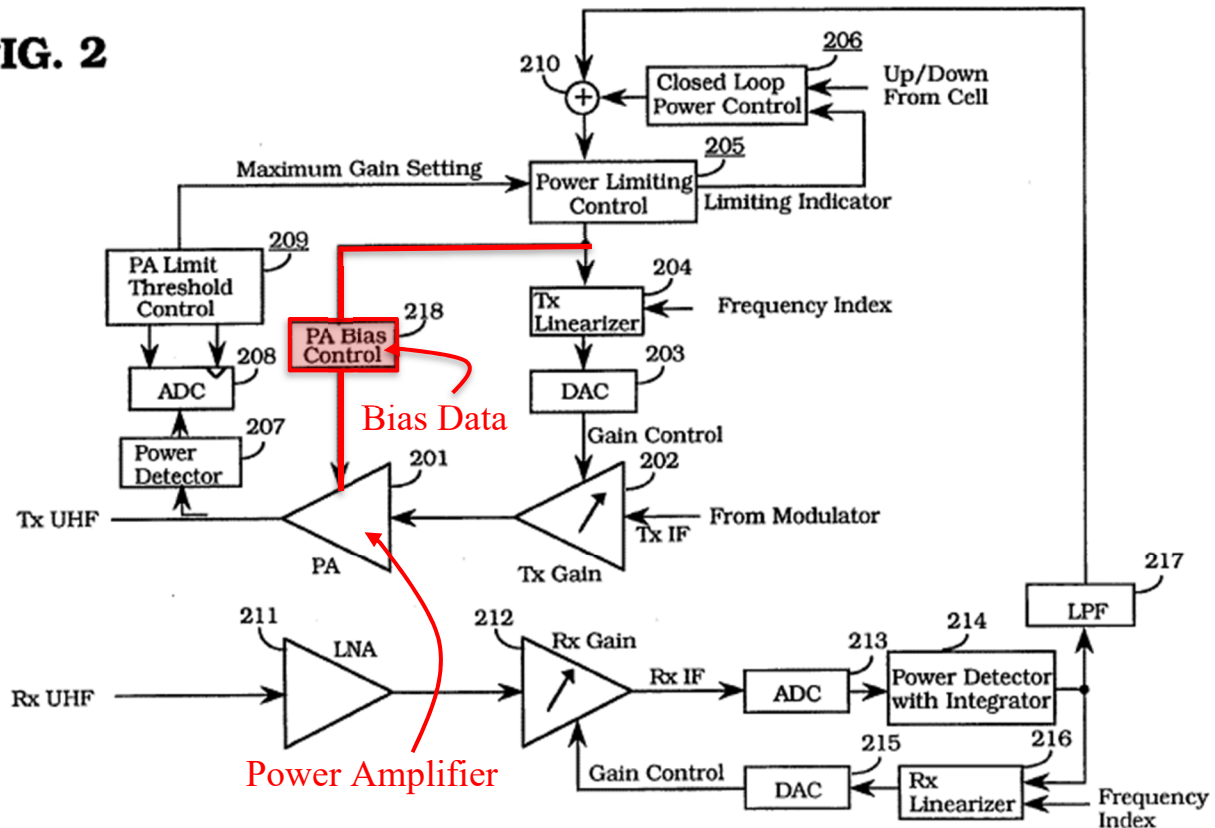
control setting is also monitored. The radiotelephone uses the detected power levels and closed loop power control setting to index a set of correction tables that indicate the reverse link transmit power error and desired power amplifier biasing for the particular operating point. The radiotelephone also determines if the transmitter is operating above a maximum set point. The transmit gain and power amplifier biasing of the radiotelephone are adjusted to correct the undesired error and maintain the desired output power.

Ex. 1004 at 2:23-41 (emphasis added).

The power amplifier (PA) bias control section (218) controls the bias point of the transmit PA (201) based on the transmit gain setting such that the transmit side bands for the given gain setting are optimized versus PA (201) current consumption. This allows a battery powered telephone to maximize talk time by reducing PA (201) current consumption at lower output powers while still maintaining acceptable sideband levels at higher output power levels.

Ex. 1004 at 4:35-43 (emphasis added). I have highlighted the control of the bias of the power amplifier 201 by the bias control section 218 in FIG. 2 below:

FIG. 2

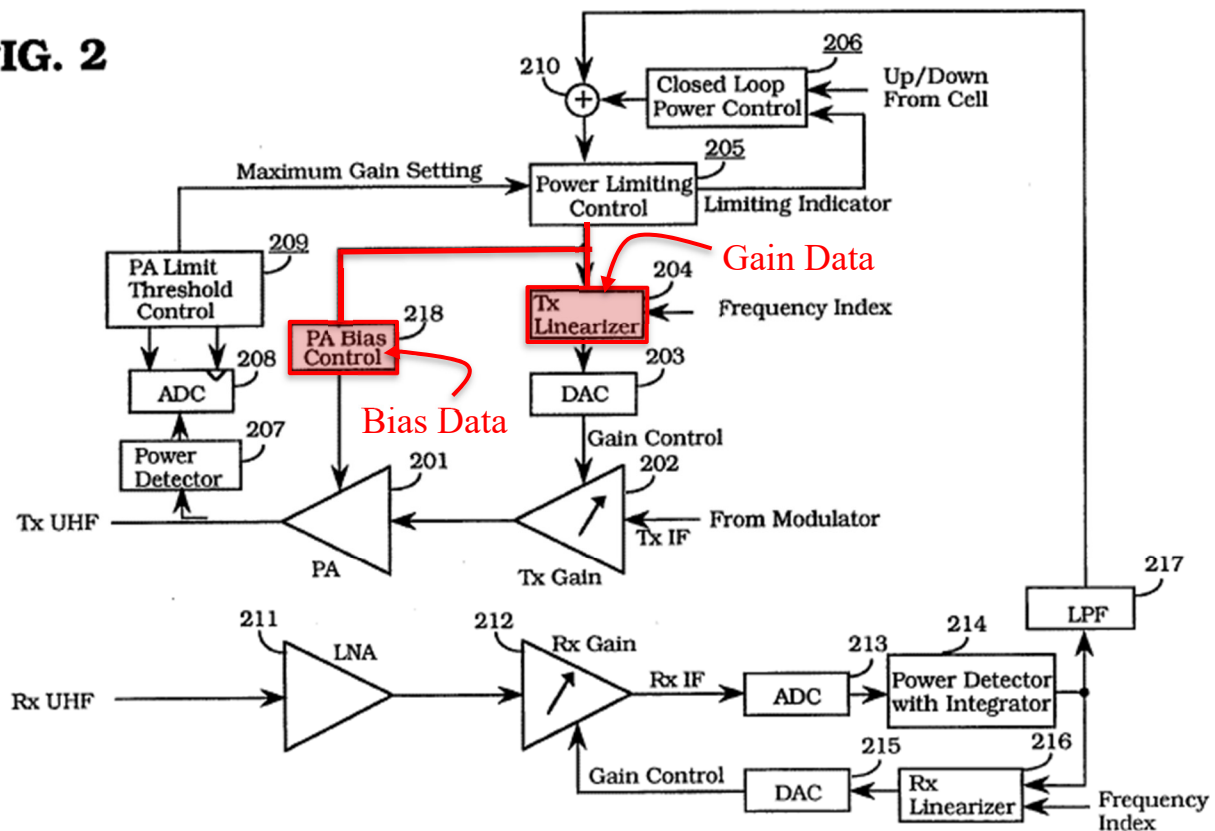


Ex. 1004 at FIG. 2 (annotated). A POSITA would have recognized that bias control section 218 uses a correction table that includes bias data, e.g., “desired power amplifier biasing for the particular operating point,” and is a data structure stored in a memory.

77. As described by Weiland, the “power control limiting section (205)” “controls ... transmit gain settings,” “the output of the power control limiting section (205) ... are used to address values stored in a transmitter linearizing table (204),” and the “power amplifier (PA) bias control section (218)” “controls the bias point of the transmit PA (201) based on the transmit gain setting” from the power limiting control section 205 by indexing a correction table that indicates the

“desired power amplifier biasing for the particular operating point.” Ex. 1004 at 2:23-41, 4:14-34, 4:35-50. Based on my knowledge and experience in this field and my review of Weiland, a POSITA would have understood that the gain of the variable amplitude amplifier and the bias condition of the power amplifier is controlled using a function that is represented by the tables storing the bias data and the gain data and that defines a relation between the stored bias data and the stored gain data. As shown in annotated FIG. 2 below, the transmit gain setting provided by the power control limiting section 205 is used to select a stored gain value and a stored bias value. Ex. 1004 at 4:14-22, 2:23-41, 4:35-43.

FIG. 2



Ex. 1004 at FIG. 2 (annotated). Because the output of the power limiting control

section 205 (i.e., the transmit gain setting) is used to select a gain value from the transmitter linearizing table 204 for adjusting the variable gain amplifier 202 and a bias value from a correction table indexed by the PA bias control section 218 to control the bias point of the transmit PA 201, each stored gain value has a corresponding stored bias value, and thus the bias values are a function of the gain values. Similar to the '334 patent, gain values and bias values, including a bias value corresponding to each gain value, are stored in memory and are determined according to transmit power. Ex. 1005 at 4:14-22, 2:23-41, 4:35-43; Ex. 1001 at 6:4-51. Thus, Weiland discloses controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in memory, as required by this element of claim 4.

[4.9] in such a manner that said function uses bias conditions defined in a ratio to the maximum bias voltage value and

78. Weiland describes controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier in such a manner that the function uses bias conditions defined in a ratio to the maximum bias voltage value. For example, as described for limitation [4.8] above, Weiland discloses a “transmitter linearizing table” that is used for the full range of output power settings—lowest to highest, that “follows a predetermined straight line with respect to transmitted RF output power.” Ex. 1004 at 4:14-34 (emphasis added). Weiland

also performs power control limiting to prevent the transmitter from operating above a maximum set point. Ex. 1004 at 2:35-38. In particular, Weiland discloses the following details regarding the power control limiting:

The power control limiting section (205) is illustrated in FIG. 3. The power control limiting section (205) controls the closed loop power control and transmit gain settings when the output of the transmit gain summer (210) corresponds to a transmit output power level which is equal to or greater than the intended maximum output power. The maximum gain setting is determined by the PA limit threshold control section (209).

The threshold control section (209) determines the maximum gain setting based on a nominal value that is modified by a real-time measurement of the transmitted output power. The measurement is accomplished by an analog power detector (207) whose output transformed into a digital signal by an analog to digital converter (208). The digitized power value is then input to the threshold control section (209).

The threshold control section, detailed in FIG. 5, operates by the high power detector (HDET) linearizer (501) scaling the input digitized power value in order to match the numerology of the digital transmit gain control section. The scaled output from the linearizer (501) is subtracted (502) from the nominal maximum gain setting. This maximum gain setting can be hard coded into the radio during assembly or input during manufacturing and testing of the radio.

The difference of the maximum gain setting and the scaled output power is then added, by the adder (503), to the maximum gain setting.

The sum of these signals is then used as the corrected maximum gain setting. This real-time modification of the detected power helps mitigate the errors introduced by temperature variations and aging of the transmitter PAs. In other words, if the difference between the maximum gain setting and the real-time measured power value is 0, then no correction is necessary. If there is a difference between the two, the difference is used to correct the maximum gain setting.

Referring to FIG. 3, a digital comparator (301) detects when the output of the transmit gain summer (210) equals or exceeds the maximum gain setting. The comparator (301) controls a 2:1 multiplexer (302) that outputs the maximum allowable setting when the output of the summer (210) exceeds the maximum allowable setting. When the output of the summer (210) is less than the maximum allowable setting, the multiplexer (302) outputs the direct output of the summer (210). This prohibits the transmitter from exceeding its maximum operating point.

Ex. 1004 at 4:44-5:23 (emphasis added).

79. As discussed above in the analysis of element [4.8], Weiland discloses controlling a bias condition of the power amplifier using bias data selected based on the transmit gain setting determined by the power control limiting section as follows:

The process of the present invention enables a radiotelephone to operate in a linear fashion over a wide dynamic range while maintaining acceptable transmit output power levels inside and outside of the return link bandwidth. The forward and return link power are measured by

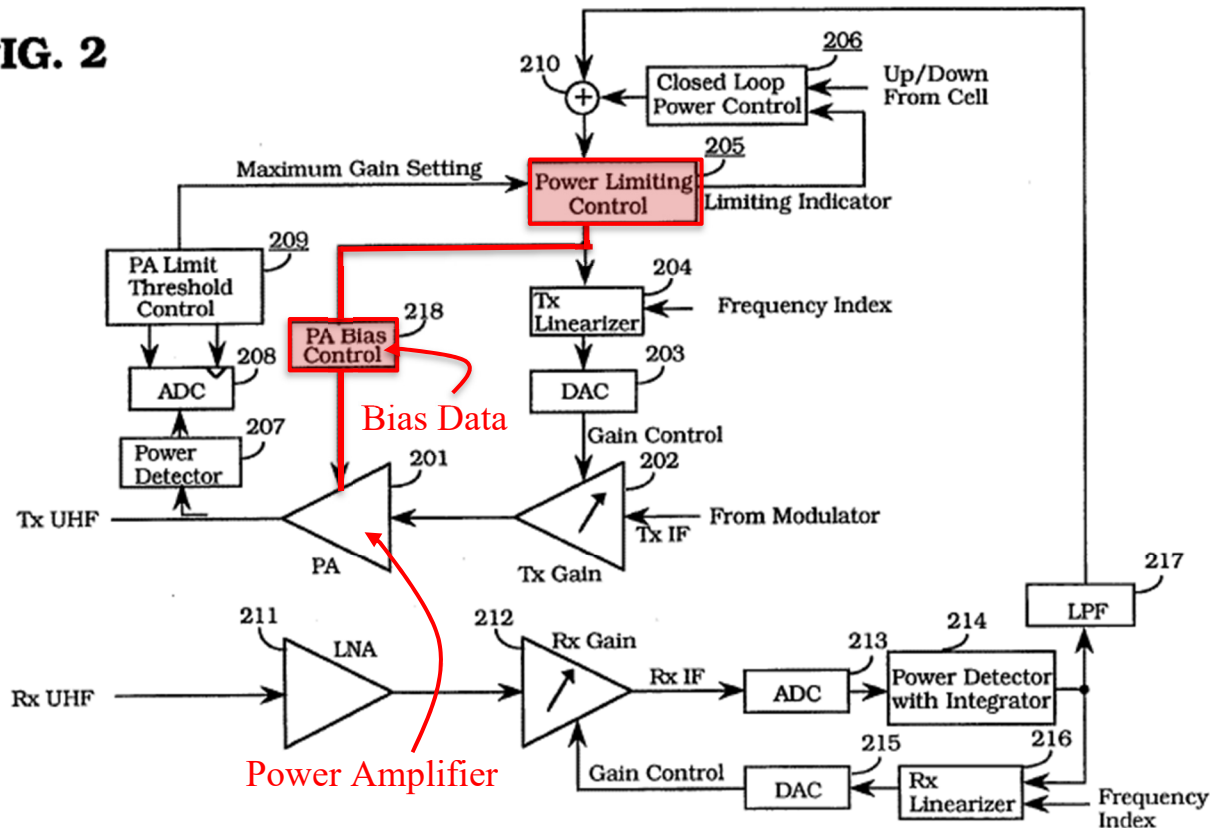
power detectors and input to an analog to digital converter accessible by both control hardware and/or software. The closed loop power control setting is also monitored. The radiotelephone uses the detected power levels and closed loop power control setting to index a set of correction tables that indicate the reverse link transmit power error and desired power amplifier biasing for the particular operating point. The radiotelephone also determines if the transmitter is operating above a maximum set point. The transmit gain and power amplifier biasing of the radiotelephone are adjusted to correct the undesired error and maintain the desired output power.

Ex. 1004 at 2:23-41 (emphasis added).

The power amplifier (PA) bias control section (218) controls the bias point of the transmit PA (201) based on the transmit gain setting such that the transmit side bands for the given gain setting are optimized versus PA (201) current consumption. This allows a battery powered telephone to maximize talk time by reducing PA (201) current consumption at lower output powers while still maintaining acceptable sideband levels at higher output power levels.

Ex. 1004 at 4:35-43 (emphasis added). I have highlighted the control of the bias of the power amplifier 201 by the bias control section 218 based on the transmit gain setting determined by the power control limiting section 205 in FIG. 2 below:

FIG. 2



Ex. 1004 at FIG. 2 (annotated). A POSITA would have recognized that the maximum allowable gain setting has a corresponding maximum bias value and that each bias value is a ratio of the maximum bias value. Weiland also discloses:

The process of the present invention provides power control correction for a mobile radiotelephone as well as maintaining acceptable in and out of band maximum emission levels. This is accomplished by real-time compensation utilizing a set of correction tables that are generated during the production testing of each radio telephone.

Ex. 1004 at 3:4-10 (emphasis added).

In order to reduce the error in the receive and transmit chains versus frequency, the receive and transmit linearizers utilize the frequency index that specifies the current center frequency on which the receive

and transmit chains are operating. During factory calibration of the radiotelephone, the linearizers are loaded with values, in addition to the previously mentioned calibration values, that are indexed by frequency to correct the errors related to operating center frequency.

Ex. 1004 at 3:47-65 (emphasis added).

The biasing of the variable gain amplifier (202) is adjusted by the analog calibration value to a point such that the input to the transmitter linearizing table (204) follows a predetermined straight line with respect to transmitted RF output power. This linearization removes the undesired linear and non-linear errors along with variations versus frequency in the transmitter. This, combined with the previously mentioned receive linearization, greatly reduces the open and closed loop power control errors due to RF performance imperfections.

Ex. 1004 at 4:23-34 (emphasis added). Thus, the function represented by the tables of gain and bias values and used to control the gain of the variable amplitude amplifier and the bias condition of the power amplifier uses bias values defined in a ratio to the maximum bias value.

[4.10] [in such a manner] that said bias condition increases gradually to the maximum value when output intensity increases to the value taken when said cellular telephone is very far from the cell-site station.

80. The combination of Weiland in view of Dent provides for controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier in such a manner that the bias condition increases gradually to the

maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station. For example, Weiland discloses the following:

The biasing of the variable gain amplifier (202) is adjusted by the analog calibration value to a point such that the input to the transmitter linearizing table (204) follows a predetermined straight line with respect to transmitted RF output power. This linearization removes the undesired linear and non-linear errors along with variations versus frequency in the transmitter. This, combined with the previously mentioned receive linearization, greatly reduces the open and closed loop power control errors due to RF performance imperfections.

Ex. 1004 at 4:23-34 (emphasis added). As discussed above in the analysis of element [4.8], “the input to the transmitter linearizing table (204)” is the “output of the power control limiting section (205),” also referred to as the “transmit gain setting,” which is used by the PA bias control section (218) to control “the bias point of the transmit PA (201).” EX1004, 2:23-41, 4:14-34, 4:35-50. Weiland discloses a “transmitter linearizing table” that is used for the full range of output power settings—lowest to highest, that “follows a predetermined straight line with respect to transmitted RF output power.” Ex. 1004 at 4:14-34 (emphasis added). Because the input to the linearizing table (204) (i.e., the transmit gain setting), which is used to control the bias point of the transmit PA, “follows a predetermined straight line with respect to transmitted RF output power,” the bias

point of the transmit PA would also follow a predetermined straight line with respect to transmitted RF output power. Also, as discussed above in the analysis of element [4.9], Weiland discloses that the “transmitter linearizing table” is used until the maximum power output is reached. Ex. 1004 at 4:14-34, 4:44-5:2. Once the maximum output power is reached, Weiland discloses a “power control limiting section” that is activated to ensure the transmitted output power does not exceed the “maximum set point.” *Id.*

81. To the extent that Weiland’s teachings of controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier are considered to not explicitly disclose that the bias condition increases gradually to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station, such a feature was commonly known in similar prior art methods of controlling a cellular telephone. For example, Dent discloses controlling the bias of the power amplifier to achieve the commanded power level:

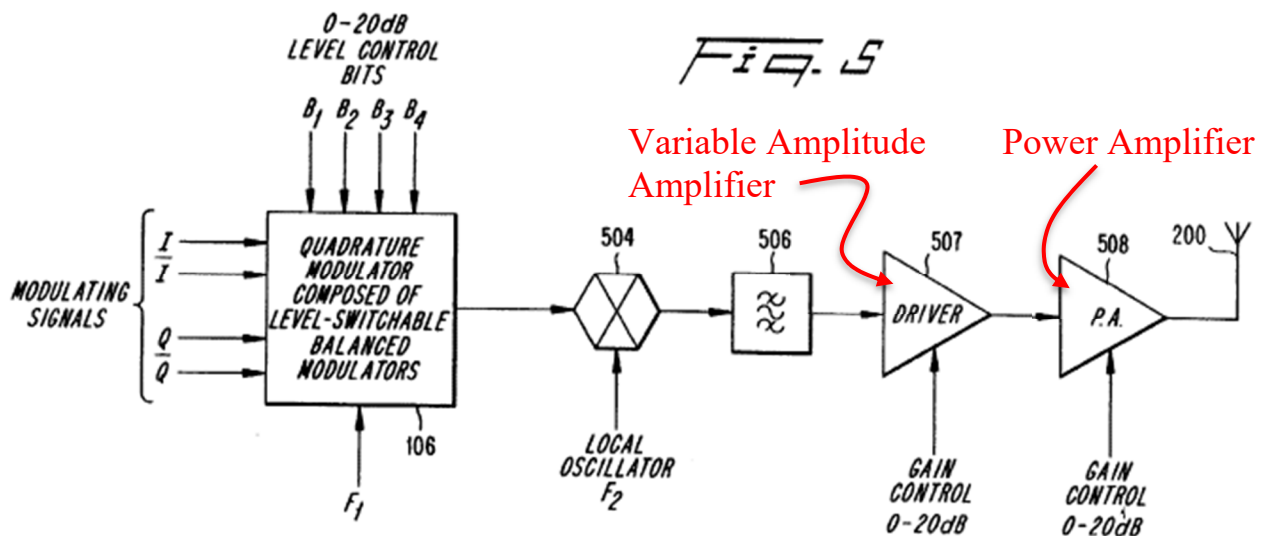
The power level controller 118 advantageously comprises a combination of attenuators and components for controlling the bias of the power amplifier 100 to achieve the commanded power level when transmitting each codeword. A combination of attenuators and amplifier bias control is useful in achieving a suitably wide transmission power level control range, e.g., 60 dB, and it will be appreciated that a wide variety of combinations are known and the

following techniques can be used as desired in the present invention.

Ex.1005 at 5:49-58 (emphasis added).

FIG. 5 is a functional schematic of a multi-stage power amplifier 50 in which modulating in-phase (I) and quadrature (Q) signals are input to a quadrature modulator 106. ... The output of the quadrature modulator 106 is input to an upconverter 504... The output of the converter 504 is input to a bandpass filter 506 and fed to a driver 507. The gain on the driver 507 [variable amplitude amplifier] is controlled between 0-20 dB by power level controller 118. The output of the driver 507 is input to a power amplifier 508, the gain of which is controlled between 0-20 dB by gain control of the power level controller 118. The output of the final amplifier 508 is input to the antenna 102 for broadcast. This circuit permits a total transmission power control range of 0-60 dB.

Ex. 1005 at 6:5-39 (emphasis added).



Ex. 1005 at FIG. 5 (annotated). To achieve the gradual increase of the

transmission power level through control of the bias of the power amplifier, the bias of the power amplifier is gradually increased to cause the corresponding gradual increase of the transmission power level.

82. Dent also discloses gradually increasing the transmission power level according to a ramp function:

In one aspect of the invention, a mobile radio station for communicating with at least one other radio station includes means for transmitting an access message to another radio station at a relatively low power level. A detecting means determines if a reply message has been received from the other radio station. The mobile station has means for retransmitting the access message at an increased power level if the reply message is not detected. The retransmitting means increases the power level of the random access transmission in accordance with a ramp function.

Ex. 1005 at 3:13-24 (emphasis added).

The power level of the initial random access message from the mobile station 10 is set by the power controller 118 at a low power level. The power controller 118 gradually increases the transmission power in small increments, e.g., 0.1 dB, after each successive codeword is transmitted. These successive power increases continue for the total number of codewords making up the random access message. Preferably, the power level increases according to a ramp function with the ramp slope determining the magnitude of the power increase increment. A ramp function is readily implemented and simplifies the

signal strength prediction process of the base station signal tracker and sorter 210. Each successive transmission of the random access message by the mobile station 10 occurs at a power level greater than the preceding access message transmission until the base station 20 detects the access message and transmits a reply message to the mobile station 10. Once that reply message is received and the base station 20 indicates that the mobile power level is in the desired signal strength range, the mobile station 10 fixes its transmitted power at a level specified by the base station 20 in the reply message.

Ex. 1005 at 8:1-23 (emphasis added).

At present the preferred approach is that the mobile station 10 includes, in its random access transmission, not only its mobile ID but also details of the power level and timing advance that the transmission used. Then the base station 20 additionally adjusts the signal and sends the absolute values back to the mobile station 10. The mobile station 10 then continues to ramp its power and its timing at the same, gentle rate until it hits the target values received from the base station 20 most recently.

Ex. 1005 at 12:7-16 (emphasis added).

If the mobile station signal was first detected by the base station 20 at the seventh attempt when it had reached about half the maximum power (in dBs) (i.e., a power byte value of 60), the mobile station 10 employed a timing advance byte value of 40, for example. The base station 20 detected the mobile station 10 while its signal was still quite weak and it is desirable for the mobile station 10 to continue increasing power by, for example 16 dB, to bring it into the target range. More over, the mobile signal was detected to be, for example, 20 uS late compared

with the base station's preferred timing window. The base station 20 acknowledgement message would thus contain the values:

Power to use byte= $60 + 16/0.5 = 92$.

Timing to use byte= $40 + 20 = 60$.

The mobile station 10, upon receipt of this message, would continue to ramp its power and timing until the commanded values are reached.

Ex. 1005 at 13:48-68 (emphasis added).

83. Dent further discloses that the transmission power level can increase to a value indicating that the mobile station is very far from the base station:

An example of the use of the above message format assumes a mobile station 10 begins a random access transmission at the lowest power level. If a signal at this level has a chance of establishing communication, the mobile station 10 cannot be very far away from the base station 20... The mobile station 10 continues to increase its power by approximately 0.1 dB per codeword so that the first repeat message will begin at about 4.1 dB higher power than the first message. With 0.5 dB quantizing of the power byte, the value included in the message would be 9. No change to the timing advance would be needed until the power levels reached much higher values without an acknowledgement from the base station 20, indicating that the mobile station 10 is at a significant distance. The maximum distance normally envisaged for cellular communications is 30 Km, for which 200 uS relative timing advance is needed to compensate for the round-trip delay. Thus, at maximum power, the timing byte included in the random access repeat message would indicate an advance in the 200 uS range.

Ex. 1005 at 13:9-36 (emphasis added).The greater the power level required, the greater the distance between the mobile station 10 and the base station 20.

Ex. 1005 at 14:28-30. Because the bias of the power amplifier is gradually increased to cause the corresponding gradual increase of the transmission power level, the bias condition increases gradually to the maximum value when the transmission power level increases to the value taken when the mobile station is very far from the base station. Thus, Dent teaches controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier in such a manner that the bias condition increases gradually to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station.

84. The combination of Weiland and Dent would result in Weiland's control of the bias condition of the power amplifier including Dent's suggested functionality for controlling the bias condition such that the bias condition gradually increases to the maximum value. Based on my knowledge and experience in this field and my review of Weiland and Dent, it would have been obvious to a POSITA to combine Weiland with Dent to include this feature in Weiland's radiotelephone and a number of reasons would have motivated a POSITA to implement Dent's suggestion for controlling the bias condition such that the bias condition gradually increases to the maximum value in Weiland's

radiotelephone, as I have explained above in ¶¶69-74.

[6] A method according to claim 4 wherein said bias condition increases gradually to the maximum value when said output intensity increases within the range of -50 dB to 0 dB.

85. The combination of Weiland in view of Dent provides that the bias condition increases gradually to the maximum value when the output intensity increases within the range of -50 dB to 0 dB. As discussed above in the analysis of element [4.10], the combination of Weiland in view of Dent provides that the bias condition increases gradually to the maximum value when the output intensity increases. See ¶¶80-84 above. Dent further discloses a transmission power control range of 60 dB:

The power level controller 118 advantageously comprises a combination of attenuators and components for controlling the bias of the power amplifier 100 to achieve the commanded power level when transmitting each codeword. A combination of attenuators and amplifier bias control is useful in achieving a suitably wide transmission power level control range, e.g., 60 dB, and it will be appreciated that a wide variety of combinations are known and the following techniques can be used as desired in the present invention.

Ex. 1005 at 5:49-58.

FIG. 5 is a functional schematic of a multi-stage power amplifier 50 in which modulating in-phase (I) and quadrature (Q) signals are input to a quadrature modulator 106. ... The output of the quadrature modulator 106 is input to an upconverter 504... The output of the

converter 504 is input to a bandpass filter 506 and fed to a driver 507. The gain on the driver 507 is controlled between 0-20 dB by power level controller 118. The output of the driver 507 is input to a power amplifier 508, the gain of which is controlled between 0–20 dB by gain control of the power level controller 118. The output of the final amplifier 508 is input to the antenna 102 for broadcast. This circuit permits a total transmission power control range of 0-60 dB.

Ex. 1005 at 6:5-39. Because Dent teaches a transmission power control range of 60 dB, which is greater than 50 dB in this limitation, in addition to a “wide variety of combinations.” Dent also teaches that the bias condition increases gradually to the maximum value when the output intensity increases within the range of -50 dB to 0 dB.

86. The combination of Weiland and Dent would result in Weiland’s control of the bias condition of the power amplifier including Dent’s suggestion for controlling the bias condition such that the bias condition gradually increases to the maximum value. Based on my knowledge and experience in this field and my review of Weiland and Dent, it would have been obvious to a POSITA to combine Weiland with Dent to include this feature in Weiland’s radiotelephone and a number of reasons would have motivated a POSITA to implement Dent’s suggestion for controlling the bias condition such that the bias condition gradually increases to the maximum value in Weiland’s radiotelephone, as I have explained above in ¶¶69-74.

87. For at least these reasons, it is clear that a POSITA would have recognized that the teachings of Weiland in view of Dent provide all elements of claims 4 and 6 of the '334 patent.

IX. ANALYSIS OF MATERO IN VIEW OF OZLUTURK AND ALBERTH

88. For the reasons articulated in detail below, and based on my review of the '334 patent, file history, and the prior art references cited here, it is clear that a POSITA would have readily understood that the teachings of Matero in view of Ozluturk and Alberth provides all the elements of claims 4 and 6.

89. Similar to the '334 patent, Matero relates to a transmitter circuit used in a CDMA radio telephone. Ex. 1006 at 1:6-9, 1:36-45, 2:25-31, 3:56-62, FIG. 3. Matero describes a typical radio telephone, which is shown in FIG. 1. Matero's radio telephone processes communication signals in a similar manner as the '334 patent's cellular telephone. As shown in FIG. 1, Matero's radio telephone includes a transmitter 14, a modulator 14A, a receiver 16, a demodulator 16A, speaker 17, microphone 19, and controller 18. Ex. 1006 at 3:19-26, 3:33-36, FIG. 3. Matero's radio telephone also includes memory 24 where constants and variables are stored and used by the controller 18 during operation of the radio telephone. Ex. 1006 at 3:44-47.

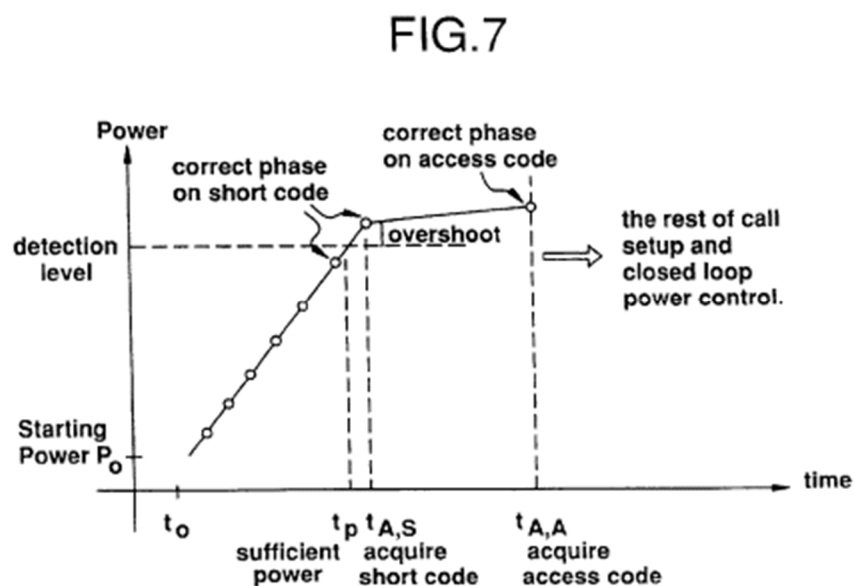
The block diagram illustrates a portable communication device 10. It features an antenna 12 connected to a TX (transmitter) block 14 and a RECEPTION block 16. The TX block 14 is also connected to a MOD (modulator) block 14A. The RECEPTION block 16 is connected to a DEMOD (demodulator) block 16A. A central CONTROLLER block 18 is connected to the MOD block 14A, the DEMOD block 16A, a KEYPAD block 22, a DISPLAY block 20, a SPEAKER block 17, a MICROPHONE block 19, and a MEMORY block 24. The KEYPAD block 22 includes sub-components 22a and 22b. The device is powered by a battery 26. Control signals TXC, GC1, and GC2 are shown originating from the antenna 12 and connecting to the TX block 14, the MOD block 14A, and the CONTROLLER block 18, respectively. An IQ signal line 18 connects the MOD block 14A and the CONTROLLER block 18.

90. Matero incorporates by reference Mattila. Ex. 1006 at 4:49-62. Mattila describes the processing of communication signals in more detail. In particular, Mattila discloses that the radio telephone receives a signal from a base station and demodulates and processes the received signal to enable a user to hear the speech of another party through the speaker. Ex. 1007 at 3:36-39, 3:45-52, 7:12-15, 7:65-8:3, FIGS. 1, 7. Mattila also discloses that a voice signal is fed from the microphone to a vocoder and a modulator, which convert the audio signal to a voice code signal and modulates the voice code signal into a communication signal. Ex. 1007 at 3:55-59, 4:36-47, FIG. 1.

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Based on the disclosed method, the subscriber unit starts the power ramp-up from a power level that is lower than the power level required for detection by a base station and increases the transmission power while repeatedly transmitting a short code until it receives an acknowledgment from the base station that the short code has been detected by the base station. Ex. 1008 at 3:13-18, 5:54-58, 6:44-54, 7:53-59, 8:17-19, 10:11-26. Upon receiving the initial acknowledgement, the subscriber unit continues to ramp-up its transmission power at a lower rate while transmitting an access code. Ex. 1008 at 8:20-30, 10:26-36. When the subscriber unit receives an access code detection acknowledgment from the base station, the subscriber unit ceases the transmission power increase and performs closed loop power control. Ex. 1008 at 6:54-59, 8:55-62, 10:37-41.

93. The transmission power output of the subscriber unit during channel establishment is shown in FIG. 7. Ex. 1008 at 3:52-53.



Ex. 1008 at FIG. 7. As shown in FIG. 7, the subscriber unit starts at power level P_0 and gradually increases the power level at a first rate until the short code is detected by the base station (detection level) and then gradually increases the power level at a second rate until the access code is detected by the base station (correct phase on access code). Ex. 1008 at 3:13-18, 5:54-58, 6:44-54, 7:53-59, 8:17-30, 8:63-9:2, 10:11-36. The subscriber unit then ceases the transmission power increase and performs closed loop power control. Ex. 1008 at 6:54-59, 8:55-62, 10:37-41.

94. Ozluturk incorporates by reference Lomp. Ex. 1008 at 1:7-10, 2:18-26. Lomp describes closed loop power control in more detail. In particular, Lomp discloses that, for closed loop power control, the base station transmits to the subscriber unit power control signals, and the subscriber unit adjusts the transmit power level according to the power control signals to maintain the transmit power level of the subscriber unit at the power level required by the base station. Ex. 1009 at 6:59-7:2, 7:24-37, 12:13-19, 61:12-16, 61:35-60, 67:39-54, 69:18-34, FIGS. 29, 30.

95. Alberth discloses a radiotelephone including a transmitter having amplifying circuitry and control circuitry for controlling the amplifying circuitry. Ex. 1010 at 2:13-37, 3:18-32, 3:39-4:8, 5:11-15, FIGS. 2, 3, 4. FIG. 4 shows the components of the transmitter including the amplifying circuitry 203 and control

Ex. 1010 at FIG. 4 (annotated). The amplifier control signal 211 is determined based on power output control values stored in memory. Ex. 1010 at 6:21-54, 6:63-67. The gate voltage signal 213 is a function of the amplifier control signal 211. Ex. 1010 at 7:66-8:3, 8:11-25, 9:31-51.

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and there were a number of reasons that would have prompted a POSITA to predictably apply the teachings of Ozluturk and Alberth to the radio telephone of Matero (as described in detail below). Based on the multiple reasons articulated below, a POSITA would have been prompted to modify the radio telephone provided by Matero to provide the conventional features suggested by Ozluturk and Alberth to achieve known benefits and as a matter of predictable and routine engineering design, especially by the relatively late time frame leading up to November 1998. As part of my analysis, I will address each of the elements of claims 4 and 6, as follows.

[4.P] A method of controlling a cellular telephone used in a CDMA system, said cellular telephone including a transmitter having a variable amplitude amplifier and a power amplifier, said method comprising the steps of:

97. Matero discloses a method of controlling a cellular telephone used in a CDMA system. For example, Matero discloses the following:

The foregoing and other problems are overcome and the objects of the invention are realized by methods and apparatus in accordance with embodiments of this invention, wherein at least one programmable gain amplifier stage is placed after a digital mode modulator and before a driver VGA, thereby distributing the gain control function over the transmitter chain, and relaxing the dynamic range requirements.

Ex. 1006 at 1:60-67.

Reference is made to FIGS. 1 and 2 for illustrating a wireless user

terminal or mobile station 10, such as but not limited to a cellular radiotelephone or a personal communicator, that is suitable for practicing this invention.

Ex. 1006 at 3:7-10 (emphasis added), FIG. 2.

It should further be appreciated that the mobile station 10 can be capable of operating with one or more air interface standards, modulation types, and access types. By example, the mobile station may be capable of operating with any of a number of other standards besides IS-136, such as GSM, DCT, PDC, and IS-95 (CDMA).

Ex. 1006 at 3:56-62 (emphasis added).

98. Matero discloses that the cellular telephone includes a transmitter having a variable amplitude amplifier and a power amplifier. For example, Matero discloses the following:

This invention relates generally to radio frequency (RF) transmitters and, in particular, for RF transmitters used in radio telephones, such as cellular telephones and personal communicator devices.

Ex. 1006 at 1:6-9 (emphasis added).

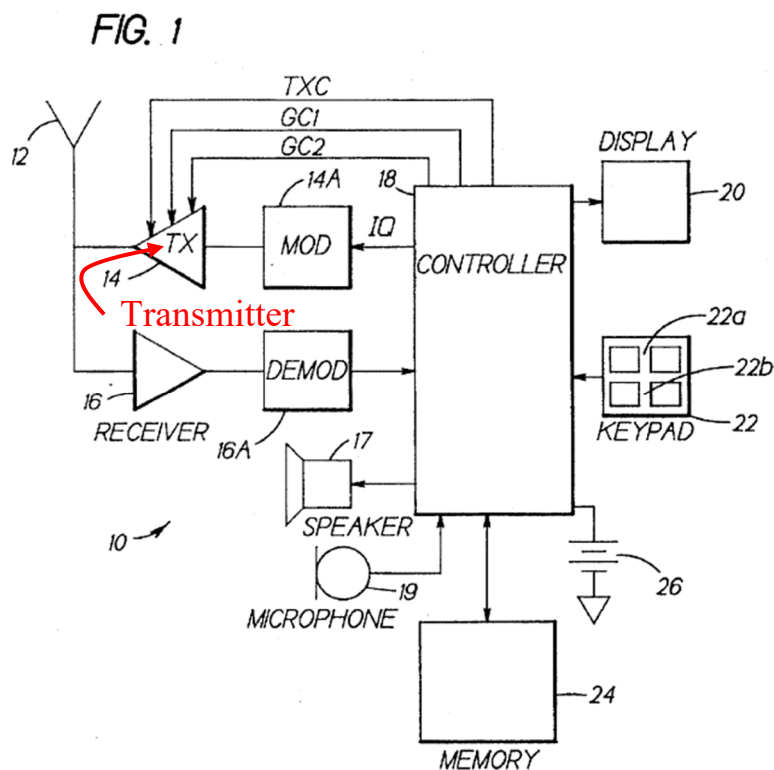
It is a first object of this invention to provide an improved transmitter for a mobile station or radio telephone, such as a cellular telephone or a personal communicator. It is a further object of this invention to provide an improved transmitter for a mobile station that employs a plurality of programmable gain amplifier stages, and that relaxes the typical 60 dB requirement of a VGA that precedes the power amplifier to a lesser value, such as 40 dB to 45 dB (i.e., less than 50

dB).

Ex. 1006 at 1:36-45 (emphasis added).

More particularly, this invention teaches a transmitter circuit for use in a radio telephone, the transmitter circuit including a power amplifier having an output coupled to an antenna for transmitting an amplified modulated RF signal; a variable gain driver amplifier having an output coupled to an input of the power amplifier and an input coupled to an output of a modulator...

Ex. 1006 at 2:25-31. FIG. 1 shows a block diagram of a cellular telephone including a transmitter 14.



Ex. 1006 at FIG. 1 (annotated). FIG. 3 shows a block diagram of the transmitter 14 including a variable gain driver amplifier 17C and a power amplifier 17D.

The diagram illustrates a transmitter system (14) with the following components and signal flow:

- Input and Feedback:** The system receives an input signal (1) and a feedback signal from the antenna (12) through an RF detector (17F) and a feedback loop (17A, 17B, 17C, 17D, 17E).
- Modulation and Phase Shifting:** The input signal (1) is processed by a modulator (MOD 14A) and a phase shifter (15A) to generate a modulated signal (MOD OUT IF).
- Amplification and Mixing:** The modulated signal is amplified by a power amplifier (PGA1) and then a power amplifier (PGA2). It is then mixed with a local oscillator (LO2) in a mixer (MIXER_1, 17G).
- Output and Reception:** The output of the mixer (17G) is connected to an antenna (12) and a receiver (16). The antenna is also connected to a receiver (16) via a coupling network (12A).
- Feedback Loop:** The feedback signal is processed by a feedback loop (17A, 17B, 17C, 17D, 17E) and a variable amplitude amplifier (17C) to provide feedback to the input.

[4.1] receiving a first communication signal and a transmitting power control signal from a cell-site station,

Reference is made to FIGS. 1 and 2 for illustrating a wireless user terminal or mobile station 10, such as but not limited to a cellular radiotelephone or a personal communicator, that is suitable for

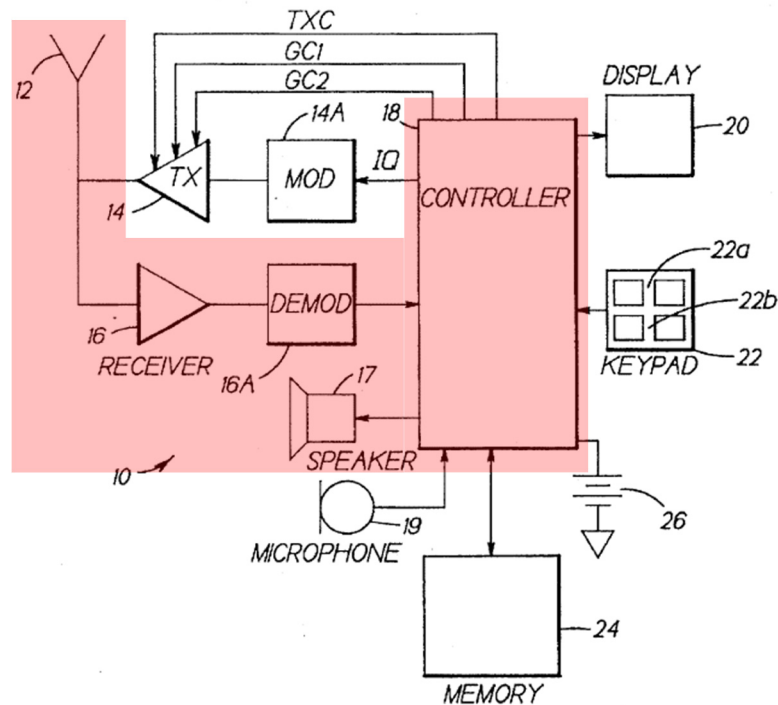
practicing this invention. The mobile station 10 includes an antenna 12 for transmitting signals to and for receiving signals from a base site or base station 30.

Ex. 1006 at 3:7-13.

The mobile station includes a modulator (MOD) 14A, a transmitter 14 (described in further detail below and in FIG. 3), a receiver 16, a demodulator (DEMOM) 16A, and a controller 18 that provides signals to and receives signals from the transmitter 14 and receiver 16, respectively. These signals include signalling information in accordance with the air interface standard of the applicable cellular system or systems, and also user speech and/or user generated data.

Ex. 1006 at 3:19-26. Matero's FIG. 1 is reproduced and highlighted below to show the components (e.g., antenna 12, and demodulator 16A) of the mobile station that receive a communication signal from a cell-site station.

FIG. 1



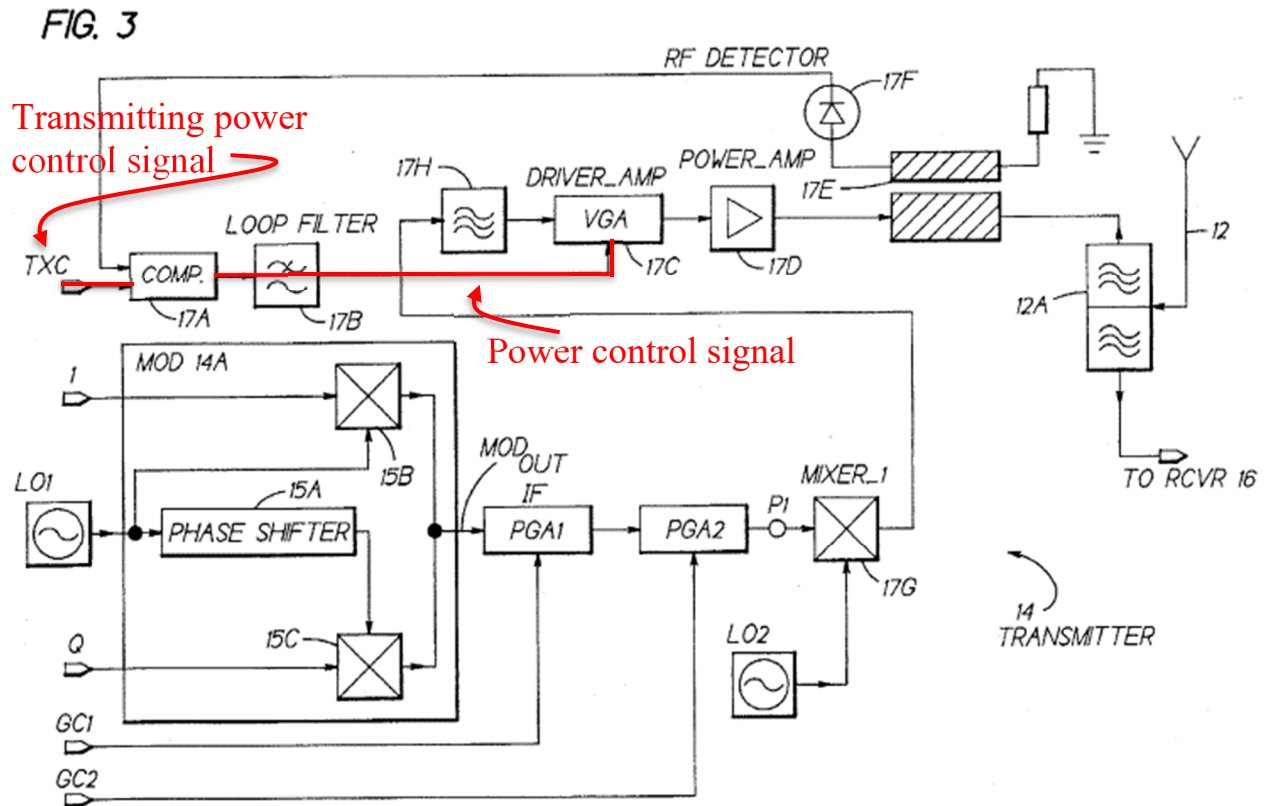
Ex. 1006 at FIG. 1 (annotated).

100. Matero also discloses a closed loop power control circuit that generates a power control signal derived from a transmitting power control signal that can either be received from a base station 30 of Fig. 2 or from the controller 18 of FIG.1. The embodiment being applied is from the base station 30 with:

The transmitter 14 includes a closed power control loop circuit comprising an input transmitter power control (TXC) signal [from base site or base station 30 of Fig. 2], a comparator 17A, a loop filter 17B, a driver VGA 17C whose output is controlled by the filtered comparator signal, a power amplifier 17D, an output coupler 17E, and a RF detector 17F. In operation, the TXC signal is compared to the output of the RF detector 17F. If the RF detector output is higher than TXC, then the

output of the comparator 17A is low. Conversely, if the RF detector output is lower than TXC, then the output of the comparator 17A is high. The output of coupler 17E is applied to a duplex filter 12A and then the antenna 12. The TXC signal may be generated by the controller 18 of FIG.1. This portion of the transmitter 14 may be conventional in construction, except for a relaxed dynamic range requirement of the driver VGA 17C, as described below.

Ex. 1006 at 4:13-28 (emphasis added). Matero's FIG. 3 shows the power control signal being generated from the transmitting power control signal:



Ex. 1006 at FIG. 3 (annotated).

101. To the extent that Matero's teachings are considered to not explicitly disclose receiving a transmitting power control signal from a cell-site station and

generating a power control signal derived from said transmitting power control signal received from said cell-site station (*see* element [4.2] below), such a feature was commonly implemented in similar prior art cellular telephones. For instance, Ozluturk discloses that a subscriber unit in a CDMA communication system performs closed loop power control. Ex. 1008 at 2:18-30, 6:54-59, 8:60-62, 10:38-41, FIGS. 5, 7, 11B. Ozluturk incorporates by reference Lomp. Ex. 1008 at 1:7-10, 2:18-26.

102. Lomp describes closed loop power control in more detail. In particular, Lomp discloses that, for closed loop power control, a transmitting power control signal is received from a cell-site station, and a power control signal is derived from the transmitting power control signal received from said cell-site station:

The present invention includes a system and method for closed loop automatic power control (AC) for the RCS [radio carrier station] and SUs [subscriber units] of the spread-spectrum communication system. The SUs transmit spread-spectrum signals, the RCS acquires the spread-spectrum signals, and the RCS detects the received power level of the spread-spectrum signals plus any interfering signal including noise. The AC system includes the RCS and a plurality of SUs, wherein the RCS transmits a plurality of forward channel information signals to the SUs as a plurality of forward channel spread-spectrum signals having a respective forward transmit power level.

Ex. 1009 at 6:59-7:2 (emphasis added).

The ARPC [automatic forward power control] system operates by measuring, in the RCS, a reverse signal-to-noise ratio of each of the respective reverse channel information signals, generating a respective reverse channel error signal representing an error between the respective reverse channel signal-to-noise ratio and a respective predetermined signal-to-noise value, and transmitting the respective reverse channel error signal as a part of a respective forward channel information signal to the SU. Each SU includes an ARPC receiver for receiving the forward channel information signal and extracting the respective reverse error signal from the forward channel information signal. The SU adjusts the reverse transmit power level of the respective reverse spread-spectrum signal responsive to the respective reverse error signal.”

Ex. 1009 at 7:24-37 (emphasis added), *see also* 12:13-19.

During the LOL [loss of lock] condition detected by the RCS, the RCS continues to transmit to the SU on the Assigned Channels, and continues to transmit power control signals to the SU to maintain SU transmit power level. The method of transmitting power control signals is described below.

Ex. 1009 at 61:12-16 (emphasis added).

The power control feature of the present invention is used to minimize the amount of transmit power used by an RCS and the SUs of the system, and the power control subfeature that updates transmit power during bearer channel connection is defined as automatic power

control (APC). AC data is transferred from the RCS to an SU on the forward APC channel and from an SU to the RCS on the reverse APC channel. When there is no active data link between the two, the maintenance power control (MPC) subfeature updates the SU transmit power.

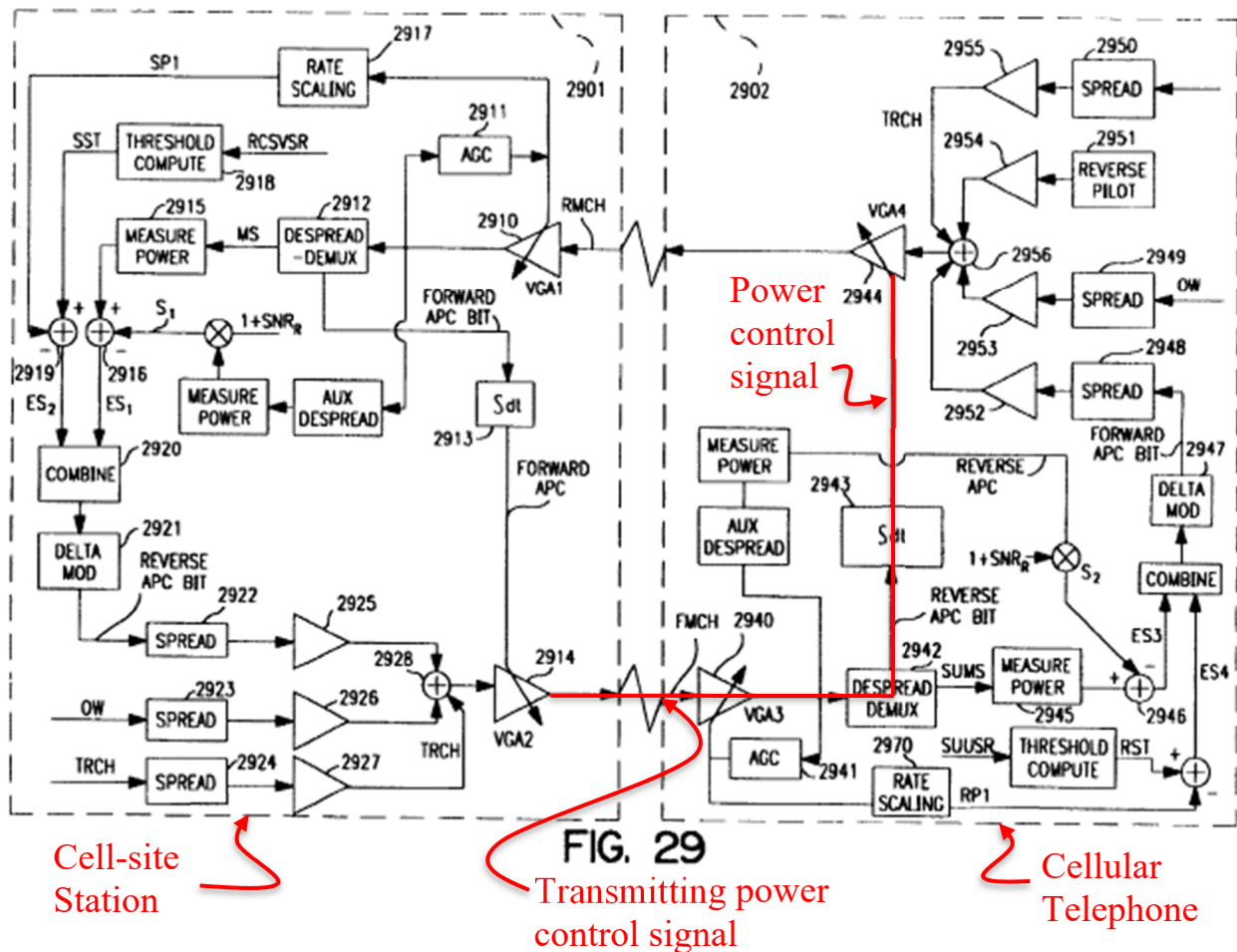
Transmit power levels of forward and reverse assigned channels and reverse global channels are controlled by the APC algorithm to maintain sufficient signal power to interference noise power ratio (SIR) on those channels, and to stabilize and minimize system output power. The present invention uses a closed loop power control mechanism in which a receiver decides that the transmitter should incrementally raise or lower its transmit power. This decision is conveyed back to the respective transmitter via the power control signal on the APC channel. The receiver makes the decision to increase or decrease the transmitter's power based on two error signals. One error signal is an indication of the difference between the measured and desired despread signal powers, and the other error signal is an indication of the average received total power.

Ex. 1009 at 61:35-60 (emphasis added).

The forward link RF channel signal including the spread forward APC signal is received by the RF antenna of the SU, and demodulated to produce the forward CDMA signal FMCH. This signal is provided to the variable gain amplifier (VGA3) 2940. The output signal of VGA3 is applied to the Automatic wax Gain Control Circuit (AGC) 2941 which produces a variable gain amplifier control signal to VGA3 2940. This signal maintains the level of the output signal of VGA3 at a

near constant level. The output signal of WAG3 2940 is despread by the despread demux 2942, which produces a despread user message signal SUMS and a reverse APC bit. The reverse APC bit is applied to the integrator 2943 which produces the Reverse APC control signal. This reverse APC control signal is provided to the Reverse APCVGA42944 to maintain the Reverse link RF channel signal at a minimum power level.

Ex. 1009 at 67:39-54, *see also* 69:18-34.



Ex. 1009 at FIG. 29 (annotated), *see also* FIG. 30.

103. The combination of Matero and Ozluturk (incorporating Lomp) would

result in Matero's mobile station including Ozluturk's suggestion for receiving a transmitting power control signal from a cell-site station, generating a power control signal derived from the transmitting power control signal received from the cell-site station, and performing a closed-loop power control according to the power control signal so as to control transmitted power to converge into a range required by the cell site station. Based on my knowledge and experience in this field and my review of Matero and Ozluturk, it would have been obvious to a POSITA to combine Matero with Ozluturk to include, in Matero's mobile station, Ozluturk's suggestion for receiving a transmitting power control signal from a cell-site station, generating a power control signal derived from the transmitting power control signal received from the cell-site station, and performing a closed-loop power control according to the power control signal so as to control transmitted power to converge into a range required by the cell site station. Multiple reasons confirm this analysis. *See, infra*, ¶¶105-108.

104. A POSITA would have predictably achieved this result with a reasonable expectation of success. Matero relates to a mobile station that performs closed loop power control. Ex. 1006 at 4:13-28, FIG. 3. Similarly, Ozluturk relates to a subscriber station that performs closed loop power control. Ex. 1008 at 2:18-30, 6:54-59, 8:60-62, 10:38-41, FIGS. 5, 7, 11B; Ex. 1009 at 6:59-7:2, 7:24-37, 12:13-19, 61:12-16, 61:35-60, 67:39-54, 69:18-34, FIGS. 29, 30. Based on my

knowledge and experience in this field and my review of Matero and Ozluturk, a POSITA would have recognized that Ozluturk provides a more detailed teaching regarding conventional functionalities for closed loop power control that includes receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from the transmitting power control signal received from the cell-site station.

105. Based on my knowledge and experience in this field, a number of reasons would have motivated a POSITA to implement Ozluturk's suggestion for closed loop power control that includes receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from the transmitting power control signal received from the cell-site station in Matero's mobile station. A POSITA would have recognized the benefits of Ozluturk's suggestion and would have been motivated to achieve these benefits of Ozluturk in Matero.

106. As a first reason, a POSITA would have recognized that closed loop power control including receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from the transmitting power control signal received from the cell-site station maintains the transmitter's output power at a minimum to stabilize and conserve output power, as stated by Ozluturk (incorporating Lomp). Ex. 1009 at 13:24-29, 61:46-53, 64:5-12. A

POSITA would have been motivated to achieve these benefits in Matero by using Matero's already present closed loop power control circuitry to provide closed loop power control that includes receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from the transmitting power control signal received from the cell-site station in order to maintain the transmitter's output power at a minimum to stabilize and conserve output power.

107. As a second reason, a POSITA would have been motivated to combine Matero's closed loop control method with Ozluturk's suggestion for receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from the transmitting power control signal received from the cell-site station. Doing so would advantageously allow Matero's mobile station to maintain sufficient signal power to interference noise power ratio (SIR) and ensure that the transmit power maintains an acceptable bit-error rate (BER), as stated by Ozluturk (incorporating Lomp). Ex. 1009 at 13:24-29, 61:46-53, 64:5-12.

108. As a third reason, a POSITA would have been prompted to incorporate Ozluturk's suggestion with Matero's system because doing so would have been a common application of a known technique (e.g., Ozluturk's suggestion that closed loop power control includes receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from

the transmitting power control signal received from the cell-site station) to a known system (e.g., Matero's mobile station that performs closed loop power control) ready for improvement to yield predictable results. As discussed above, both Matero and Ozluturk disclose cellular telephones that perform closed loop power control. Based upon my knowledge and experience in this field and my review of Matero and Ozluturk, it is clear that a POSITA would have recognized that applying Ozluturk's teachings to Matero's mobile station would have led to predictable results, with Matero's mobile station including Ozluturk's suggestion for closed loop power control that includes receiving a transmitting power control signal from a cell-site station and generating a power control signal derived from the transmitting power control signal received from the cell-site station. This implementation (applying Ozluturk's teachings to Matero's mobile station) would not have significantly altered or hindered the functions performed by Matero's mobile station, and it would have been a relatively straightforward and ordinary task for a POSITA (certainly by the relatively late time frame leading up to November 1998).

[4.2] generating a power control signal derived from said transmitting power control signal received from said cell-site station,

109. The combination of Matero and Ozluturk provides generating a power control signal derived from said transmitting power control signal received from said cell-site station, as discussed in the analysis of element [4.1] in ¶¶99-108

above and incorporated here.

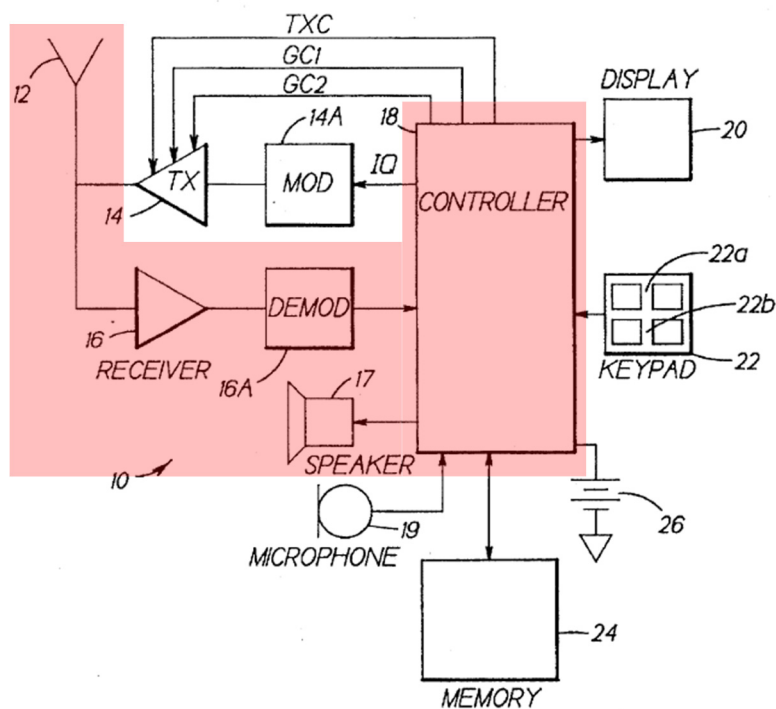
[4.3] converting said first communication signal received from a cell-site station into a voice signal code,

110. Matero discloses converting the first communication signal received from the cell-site station into a voice signal code. For example, Matero discloses the following:

The mobile station includes a modulator (MOD) 14A, a transmitter 14 (described in further detail below and in FIG. 3), a receiver 16, a demodulator (DEMOM) 16A, and a controller 18 that provides signals to and receives signals from the transmitter 14 and receiver 16, respectively. These signals include signalling information in accordance with the air interface standard of the applicable cellular system or systems, and also user speech and/or user generated data.

Ex. 1006 at 3:19-26 (emphasis added). Matero's FIG. 1 is reproduced and highlighted below to show the component (e.g., demodulator 16A) of the mobile station that converts the communication signal received from the cell-site station into a voice signal code.

FIG. 1



Ex. 1006 at FIG. 1 (annotated).

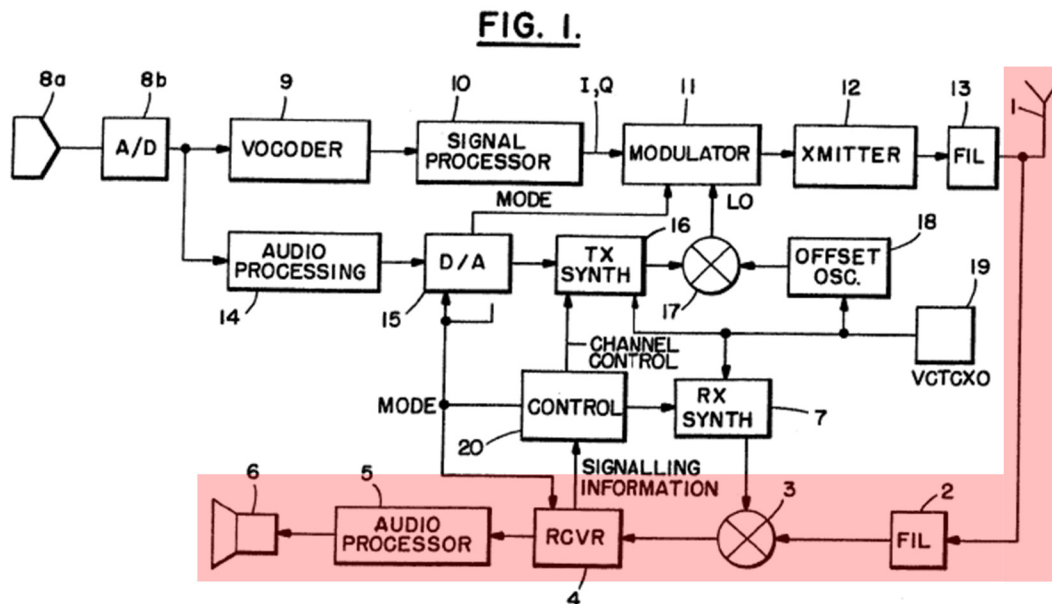
111. Matero incorporates by reference Mattila. Ex. 1006 at 4:49-62.

Mattila provides more details regarding the components of the mobile station that convert the communication signal received from the cell-site station into a voice signal code. For example, Mattila discloses the following:

The receiver block (4) demodulates and processes the received signal and provides the processed received signal to an audio processing block (5). The required audio processing is accomplished digitally or in an analog manner, depending on the operating mode. The output of the audio processor 5 drives a loudspeaker (6) whereby a user is enabled to hear the speech of another party during a conversation.

Ex. 1007 at 3:45-52 (emphasis added). Mattila's FIG. 1 is reproduced and

highlighted below to show the components (e.g., receiver 4 and audio processor 5) of the mobile station that convert the communication signal received from the cell-site station into a voice signal code.



Ex. 1007 at FIG. 1 (annotated). In this respect, Matero is much like the '334 patent. The '334 patent also describes the receiver 100 including demodulators that demodulate the communication signal and convert the demodulated signal into a voice code signal. Ex. 1001 at 4:49-60, 5:1-13.

[4.4] converting said voice signal code into an audio signal for driving an acoustic transducer of said cellular telephone,

112. Matero discloses converting the voice signal code into an audio signal for driving an acoustic transducer of the cellular telephone. For example, Matero discloses the following:

The mobile station includes a modulator (MOD) 14A, a transmitter

14 (described in further detail below and in FIG. 3), a receiver 16, a demodulator (DEMOD) 16A, and a controller 18 that provides signals to and receives signals from the transmitter 14 and receiver 16, respectively. These signals include signalling information in accordance with the air interface standard of the applicable cellular system or systems, and also user speech and/or user generated data.

Ex. 1006 at 3:19-26 (emphasis added).

A user interface includes a conventional earphone or speaker 17, a conventional microphone 19, a display 20, and a user input device, typically a keypad 22, all of which are coupled to the controller 18.

Ex. 1006 at 3:33-36 (emphasis added). Matero's FIG. 3 is reproduced and highlighted below to show the components (e.g., demodulator (DEMOD) 16A, controller 18, and speaker 17) of the mobile station that convert the voice signal code into an audio signal for driving an acoustic transducer.

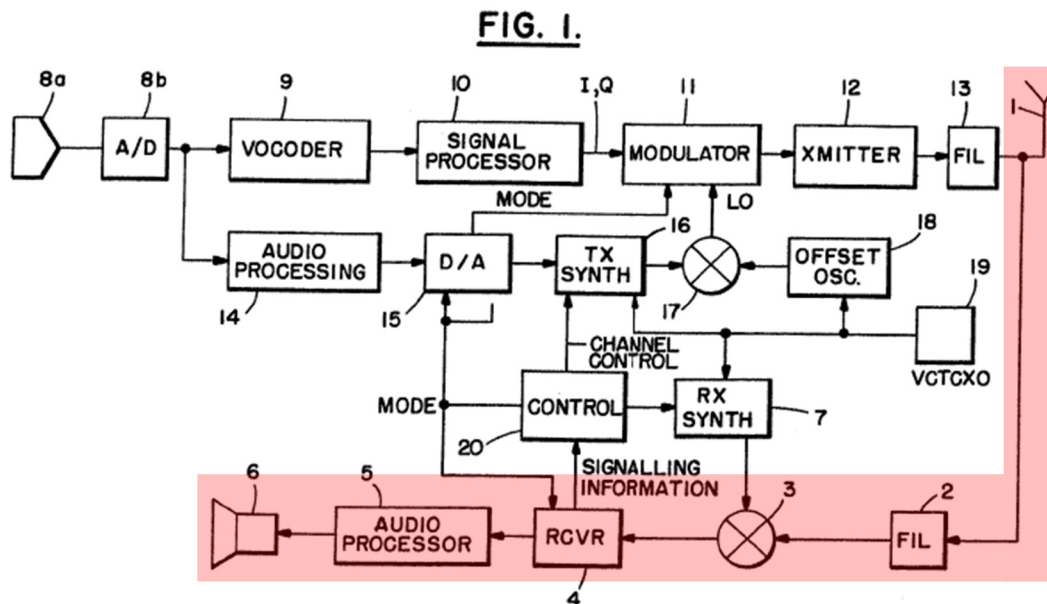
The block diagram illustrates a portable communication device 10. It features an antenna 12 connected to a TX (transmitter) block 14 and a RECEPTION block 16. The TX block 14 is also connected to a MOD (modulator) block 14A. The MOD block 14A is connected to a CONTROLLER block 18. The CONTROLLER block 18 is connected to a DISPLAY block 20, a KEYPAD block 22, a MICROPHONE block 19, a SPEAKER block 17, and a MEMORY block 24. The KEYPAD block 22 includes four buttons labeled 22a, 22b, 22c, and 22d. The MICROPHONE block 19 is connected to the CONTROLLER block 18. The SPEAKER block 17 is connected to the CONTROLLER block 18. The MEMORY block 24 is connected to the CONTROLLER block 18. The device is powered by a battery 26 connected to ground. The TX block 14 is also connected to a TXC (transmitting circuit) block 12A. The TXC block 12A is connected to the antenna 12. The TXC block 12A is also connected to a GC1 (gate control 1) block 12B and a GC2 (gate control 2) block 12C. The GC1 block 12B is connected to the TX block 14. The GC2 block 12C is connected to the RECEPTION block 16. The TXC block 12A is also connected to the MOD block 14A. The TXC block 12A is also connected to the CONTROLLER block 18. The TXC block 12A is also connected to the DISPLAY block 20. The TXC block 12A is also connected to the KEYPAD block 22. The TXC block 12A is also connected to the MICROPHONE block 19. The TXC block 12A is also connected to the SPEAKER block 17. The TXC block 12A is also connected to the MEMORY block 24.

113. Matero incorporates by reference Mattila. Ex. 1006 at 4:49-62.

Mattila provides more details regarding the components of the mobile station that convert the voice signal code into an audio signal for driving the speaker. For example, Mattila discloses the following:

Ex. 1007 at 3:45-52 (emphasis added). Mattila's FIG. 1 is reproduced and

highlighted below to show the components (e.g., audio processor 5 and speaker 6) of the mobile station that convert the voice signal code into an audio signal for driving the acoustic transducer.



Ex. 1007 at FIG. 1 (annotated). In this respect, Matero is much like the '334 patent. The '334 patent also describes the voice code signal is converted to an audio signal by an encoder/decoder apparatus and provided to a speaker. Ex. 1001 at 4:49-60, 5:1-13.

[4.5] converting an audio input signal from said acoustic transducer into an input voice code signal,

114. Matero discloses converting an audio input signal from an acoustic transducer into an input voice code signal and converting the input voice code signal into a second communication signal. For example, Matero discloses

The mobile station includes a modulator (MOD) 14A, a transmitter

14 (described in further detail below and in FIG. 3), a receiver 16, a demodulator (DEMOD) 16A, and a controller 18 that provides signals to and receives signals from the transmitter 14 and receiver 16, respectively. These signals include signalling information in accordance with the air interface standard of the applicable cellular system or systems, and also user speech and/or user generated data.

Ex. 1006 at 3:19-26 (emphasis added).

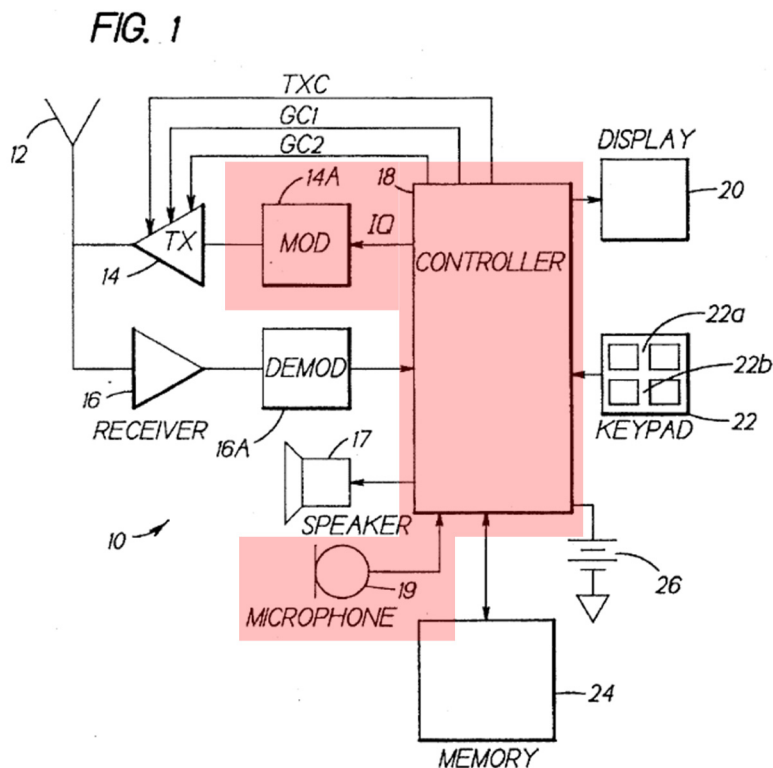
A user interface includes a conventional earphone or speaker 17, a conventional microphone 19, a display 20, and a user input device, typically a keypad 22, all of which are coupled to the controller 18.

Ex. 1006 at 3:33-35 (emphasis added).

Also illustrated is a digital portion of the modulator 14A which, for the purposes of this invention, can be considered as being conventional in construction and operation. That is, the modulator 14A has inputs for receiving In-phase and Quadrature (I/Q) signals and a first local oscillator (LO1) signal. The modulator 14A includes a phase shifter 15A, a first mixer 15B, and a second mixer 15C. An output of the modulator (MOD_{OUT}) is a $\pi/4$ -DQPSK modulated speech, data or signalling information signal that is intended to be transmitted to the base station 30 of FIG. 2.

Ex. 1006 at 4:3-12 (emphasis added), *see also* 5:10-21. Matero's FIG. 1 is reproduced and highlighted below to show the components (e.g., microphone 19, controller 18, and modulator 14A) of the mobile station that convert an audio input signal from a microphone into an input voice code signal and convert the input

voice code signal into a second communication signal.



Ex. 1006 at FIG. 1 (annotated).

115. Matero incorporates by reference Mattila. Ex. 1006 at 4:49-62.

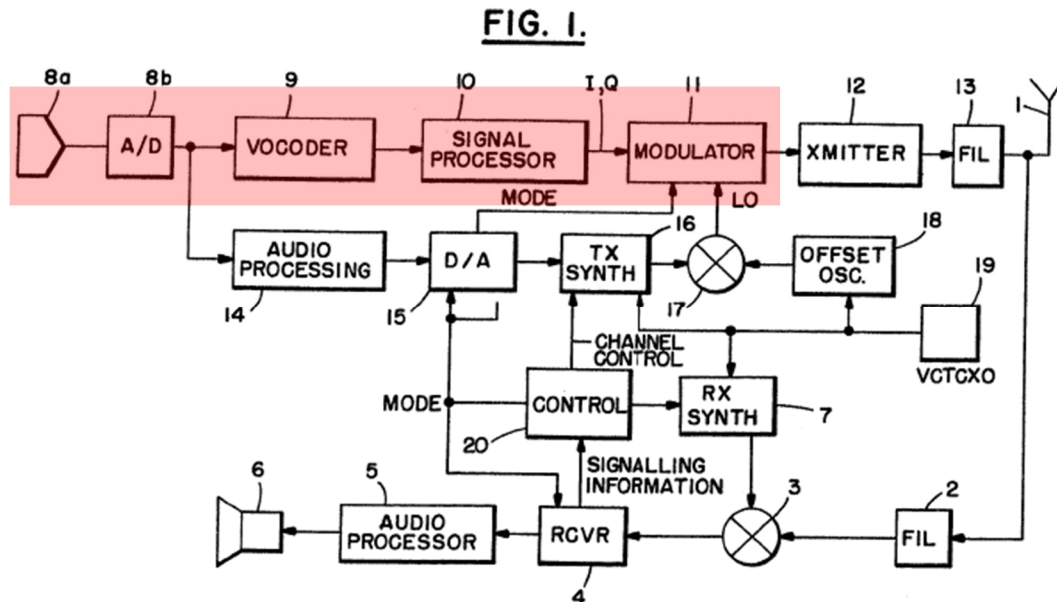
Mattila provides more details regarding the components of the mobile station that convert an audio input signal from a microphone into an input voice code signal.

For example, Mattila discloses the following:

A voice signal is fed from a microphone (8) to an analog to digital (A/D) converter (8a) and thence to a vocoder (9), in the digital mode, or to an audio processing block (14) for audio shaping and companding in the analog mode.

Ex. 1007 at 3:55-59 (emphasis added). Mattila's FIG. 1 is reproduced and

highlighted below to show the components (e.g., microphone 8, vocoder 9, and modulator 11) of the mobile station that convert an audio input signal from a microphone into an input voice code signal.



Ex. 1007 at FIG. 1 (annotated). In this respect, Matero is much like the '334 patent. The '334 patent discloses that a microphone provides an audio signal to an encoder/decoder apparatus, which converts the audio signal to a voice code signal.

Ex. 1001 at 5:14-34.

[4.6] converting said input voice code signal into a second communication signal,

116. Matero discloses converting the input voice code signal into a second communication signal. For example, Matero discloses

The mobile station includes a modulator (MOD) 14A, a transmitter 14 (described in further detail below and in FIG. 3), a receiver 16, a demodulator (DEMOM) 16A, and a controller 18 that provides signals

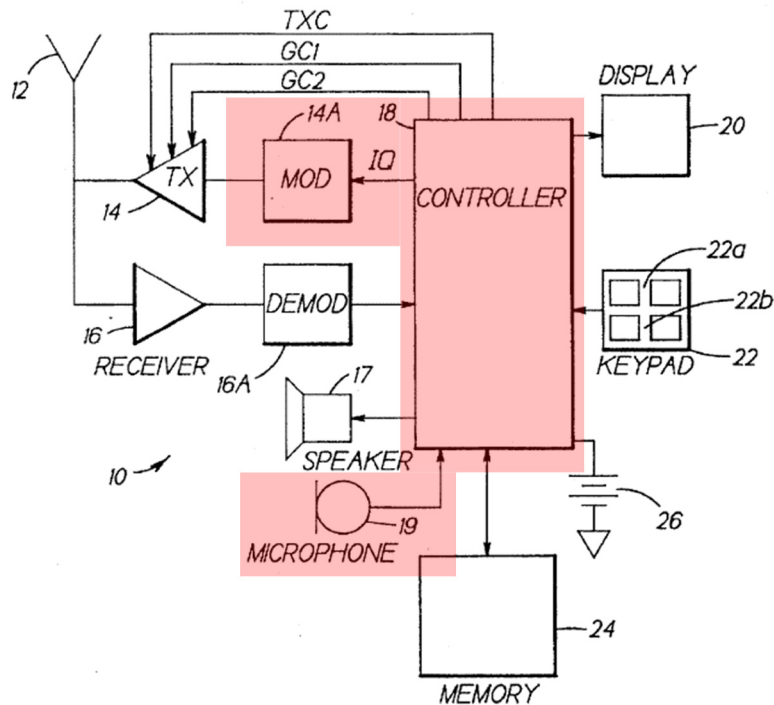
to and receives signals from the transmitter 14 and receiver 16, respectively. These signals include signalling information in accordance with the air interface standard of the applicable cellular system or systems, and also user speech and/or user generated data.

Ex. 1006 at 3:19-26 (emphasis added).

Also illustrated is a digital portion of the modulator 14A which, for the purposes of this invention, can be considered as being conventional in construction and operation. That is, the modulator 14A has inputs for receiving In-phase and Quadrature (I/Q) signals and a first local oscillator (LO1) signal. The modulator 14A includes a phase shifter 15A, a first mixer 15B, and a second mixer 15C. An output of the modulator (MOD_{OUT}) is a $\pi/4$ -DQPSK modulated speech, data or signalling information signal that is intended to be transmitted to the base station 30 of FIG. 2.

Ex. 1006 at 4:3-12 (emphasis added), *see also* 5:10-21. Matero's FIG. 1 is reproduced and highlighted below to show the components (e.g., microphone 19, controller 18, and modulator 14A) of the mobile station that convert an audio input signal from a microphone into an input voice code signal and convert the input voice code signal into a second communication signal.

FIG. 1



Ex. 1006 at FIG. 1 (annotated).

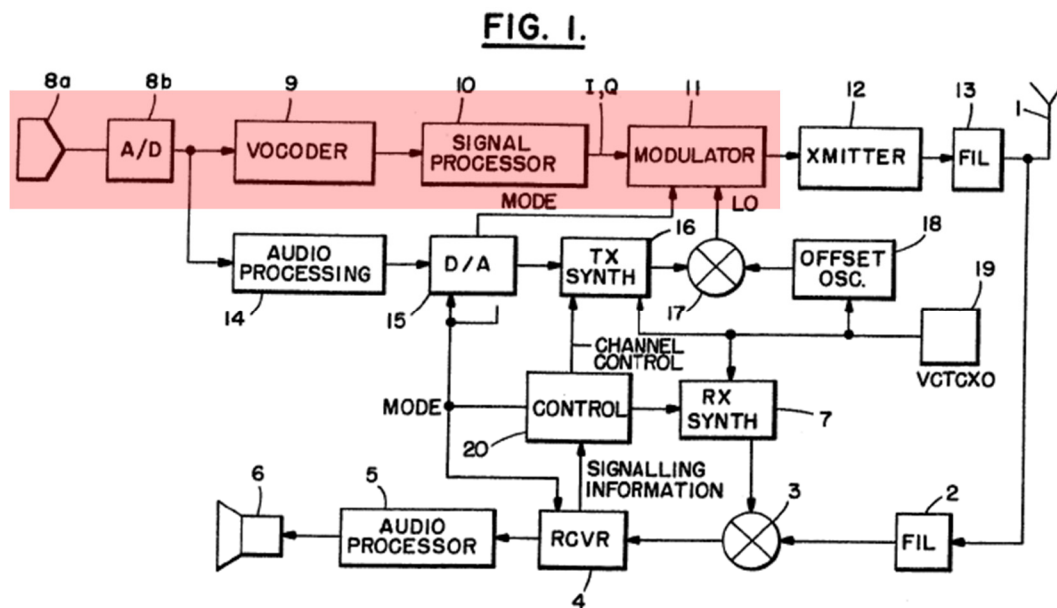
117. Matero incorporates by reference Mattila. Ex. 1006 at 4:49-62.

Mattila provides more details regarding the components of the mobile station that convert the input voice code signal into a second communication signal. For example, Mattila discloses the following:

In the digital mode of operation the vocoded digital signal is further processed in a signal processing block (10) and fed to a dual-mode modulator (11) that operates in accordance with the invention. The transmitter injection signal (LO) is also input to the dual-mode modulator (11). After I/O modulation, the transmitter signal is amplified in a transmitter block (12) and fed to a bandpass filter (13) for removing spurious signals. The filtered transmitter signal is then fed

to the antenna (1) for transmission, typically, to the base station that serves the cell within which the mobile terminal is located.

Ex. 1007 at 4:36-47 (emphasis added). Mattila's FIG. 1 is reproduced and highlighted below to show the components (e.g., modulator 11) of the mobile station that convert the input voice code signal into a second communication signal.



Ex. 1007 at FIG. 1 (annotated). In this respect, Matero is much like the '334 patent. The '334 patent discloses that the voice code signal is modulated by modulators into a communication signal. Ex. 1001 at 5:14-34.

[4.7] controlling said transmitter in such a manner that an open-loop power control is performed at first and then a closed-loop power control is performed according to said power control signal so as to control transmitted power to converge into a range required by said cell site station, and

118. The combination of Matero in view of Ozluturk provides controlling

the transmitter in such a manner that an open-loop power control is performed at first and then a closed-loop power control is performed according to the power control signal so as to control transmitted power to converge into a range required by the cell site station. For the reasons discussed above in the analysis of elements [4.1]-[4.2], the combination of Matero in view of Ozluturk provides controlling the transmitter to perform a closed-loop power control according to the power control signal so as to control transmitted power to converge into a range required by the cell site station. *See, supra*, ¶¶99-109.

119. To the extent that Matero's teachings are considered to not explicitly disclose controlling the transmitter in such a manner that an open-loop power control is performed at first and then the closed-loop power control is performed, such a feature was commonly implemented in similar prior art cellular telephones. The '334 patent acknowledges that this feature is present in the prior art IS-95 standard for the CDMA cellular telephone system. Ex. 1001 at 1:26-27, 1:47-61. In particular, the '334 patent discloses that "[i]n IS-95, open-loop power control and closed-loop power control are employed in order to regulate a receiving power at the cell-site station" and "the transmitter performs the open-loop power control at first, then it performs the closed-loop power control for the transmitted power to converge into a desired value which the cell-site station requires." Ex. 1001 at 1:47-61. Indeed, this feature is described in only the "Description of the Related

Art” section of the ’334 patent.

120. In addition, Ozluturk discloses a subscriber unit that controls transmission power during establishment of a channel. Ex. 1008 at 3:7-20, 6:44-59, 8:60-62, 10:11-41, FIGS. 5, 7, 11A, 11B. Ozluturk discloses that, for establishment of a channel, the subscriber unit performs open-loop power control first and then closed-loop power control as follows:

The present invention comprises a novel method of controlling transmission power during the establishment of a channel in a CDMA communication system by utilizing the transmission of a short code from a subscriber unit to a base station during initial power ramp-up. The short code is a sequence for detection by the base station which has a much shorter period than a conventional spreading code. The ramp-up starts from a power level that is guaranteed to be lower than the required power level for detection by the base station. The subscriber unit quickly increases transmission power while repeatedly transmitting the short code until the signal is detected by the base station. Once the base station detects the short code, it sends an indication to the subscriber unit to cease increasing transmission power.

Ex. 1008 at 3:7-20 (emphasis added), *see also* 5:54-58.

When it is desired to initiate a communication link, the subscriber unit 16 starts transmitting the access code 42 back to the base station 14 (step 106). The subscriber unit 16 continuously increases the transmission power while retransmitting the access code 42 (step 108) until it receives an acknowledgment from the base station 14. The base

station 14 detects the access code 42 at the correct phase once the minimum power level for reception has been achieved (step 110). The base station 14 subsequently transmits an access code detection acknowledgment signal (step 112) to the subscriber unit 16. Upon receiving the acknowledgment, the subscriber unit ceases the transmission power increase (step 114). With the power ramp-up completed, closed loop power control and call setup signaling is performed (step 116) to establish the two-way communication link.

Ex. 1008 at 6:44-59 (emphasis added), *see also* 7:53-59.

With the power ramp-up completed, closed loop power control and call setup signaling is performed (Step 180) to establish the two-way communication link.

Ex. 1008 at 8:60-62 (emphasis added).

An overview of the ramp-up procedure in accordance with the preferred current invention is summarized in FIGS. 11A and 11B. The base station 14 transmits a pilot code while searching for the short code (step 200). The subscriber unit 16 acquires the pilot code transmitted from the base station 14 (step 202), starts transmitting a short code starting at a minimum power level P_0 which is guaranteed to be less than the required power, and quickly increases transmission power (step 204). Once the received power level at the base station 14 reaches the minimum level needed for detection of the short code (step 206) the base station 14 acquires the correct phase of the short code, transmits an indication of this detection, and begins searching for the access code (step 208). Upon receiving the detection indication, the subscriber unit 16 ceases transmitting the short code and starts transmitting an access

code. The subscriber unit 16 initiates a slow ramp-up of transmit power while sending the access code (step 210). The base station 14 searches for the correct phase of the access code by searching only one phase out of each short code length portion of the access code (step 212). If the base station 14 searches the phases of the access code up to the maximum round trip delay and has not detected the correct phase, the search is repeated by searching every phase (step 214). Upon detection of the correct phase of the access code by the base station 14, the base station 14 sends an acknowledgment to the subscriber unit 16 (step 216). Reception of the acknowledgment by the subscriber unit 16 concludes the ramp-up process. A closed loop power control is established, and the subscriber unit 16 continues the call setup process by sending related call setup messages (step 218).

Ex. 1008 at 10:11-41 (emphasis added). Based on my knowledge and experience in this field and my review of the prior art references, a POSITA would have recognized that Ozluturk's ramp-up process prior to receiving the acknowledgment message from the base station is an example of open-loop power control because open-loop power control is "the power control performed by the radio by itself without control input from the cells." Ex. 1004 at 3:66-4:1. Thus, Ozluturk teaches performing open-loop power control at first and then closed-loop power control to control transmitted power to converge into a range required by the cell site station.

121. The combination of Matero and Ozluturk would result in Matero's

method for controlling the transmitter including Ozluturk's suggestion for performing open-loop power control at first and then closed-loop power control during establishment of a channel. Applying Ozluturk's teachings to Matero's system would have led to Matero's system first performing, during establishment of a channel, an open-loop power control in which the power is ramped up to connect to a base station and then performing a closed-loop control of the transmitter power level. Based on my knowledge and experience in this field and my review of Matero and Ozluturk, it would have been obvious to a POSITA to combine Matero with Ozluturk to include, in Matero's method for controlling the transmitter, Ozluturk's suggestion for performing open-loop power control at first and then closed-loop power control during establishment of a channel. Multiple reasons confirm this analysis. *See, supra*, ¶¶105-108; *infra*, ¶123.

122. A POSITA would have predictably achieved this result with a reasonable expectation of success. *See, supra*, ¶¶103-104. Based on my knowledge and experience in this field, additional reasons would have motivated a POSITA to implement Ozluturk's suggestion for performing open-loop power control at first and then closed-loop power control. A POSITA would have recognized the benefits of Ozluturk's suggestion and would have been motivated to achieve these benefits of Ozluturk in Matero.

123. As an additional reason, a POSITA would have recognized that "[t]he

control of transmission power is particularly critical when a subscriber unit is attempting to initiate communications with a base station and a power control loop has not yet been established” and controlling a subscriber unit’s transmission power by ramping up the power level from an initial low power level (e.g., open-loop power control) until an acknowledgment message is received from a base station (e.g., closed-loop power control) provides the benefit of avoiding sudden introduction of a strong interference, which improves system capacity, as stated by Ozluturk. Ex. 1008 at 2:27-41, 5:54-58. A POSITA would have been motivated to achieve these benefits in Ozluturk by controlling Matero’s transmitter during channel establishment as suggested by Ozluturk.

[4.8] controlling a gain of said variable amplitude amplifier and a bias condition of said power amplifier using a function defining a relation between bias data and gain data stored in said memory,

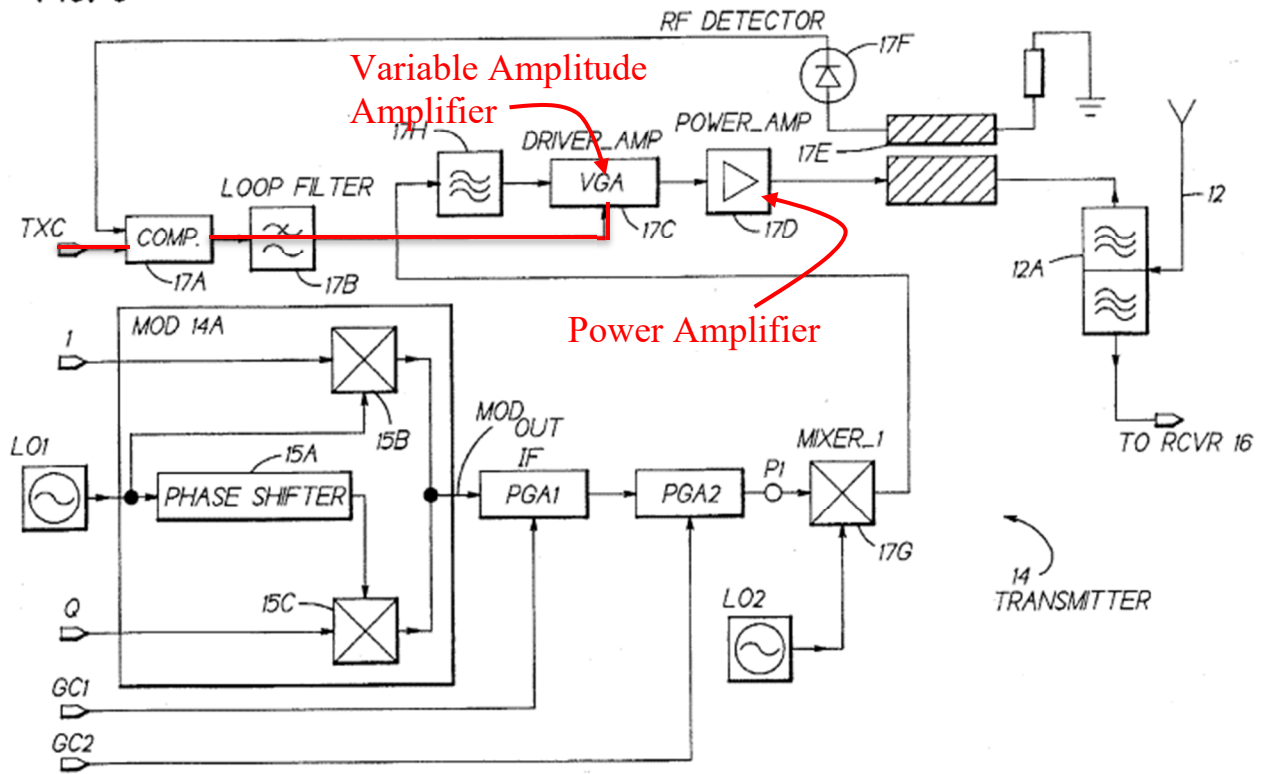
124. The combination of Matero in view of Alberth provides controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in a memory. As discussed above in the analysis of element [4.P], Matero discloses a transmitter having a variable amplitude amplifier and a power amplifier. See, *supra*, ¶¶97-98. Matero also discloses controlling the gain of the variable amplitude amplifier:

The transmitter 14 includes a closed power control loop circuit comprising an input transmitter power control (TXC) signal, a

comparator 17A, a loop filter 17B, a driver VGA 17C whose output is controlled by the filtered comparator signal, a power amplifier 17D, an output coupler 17E, and a RF detector 17F. In operation, the TXC signal is compared to the output of the RF detector 17F. If the RF detector output is higher than TXC, then the output of the comparator 17A is low. Conversely, if the RF detector output is lower than TXC, then the output of the comparator 17A is high. The output of coupler 17E is applied to a duplex filter 12A and then the antenna 12. The TXC signal may be generated by the controller 18 of FIG.1. This portion of the transmitter 14 may be conventional in construction, except for a relaxed dynamic range requirement of the driver VGA 17C, as described below.

Ex. 1006 at 4:13-28. Matero's FIG. 3 shows the variable amplitude amplifier (VGA) and the power amplifier and that the gain of the variable amplitude amplifier is controlled using a signal:

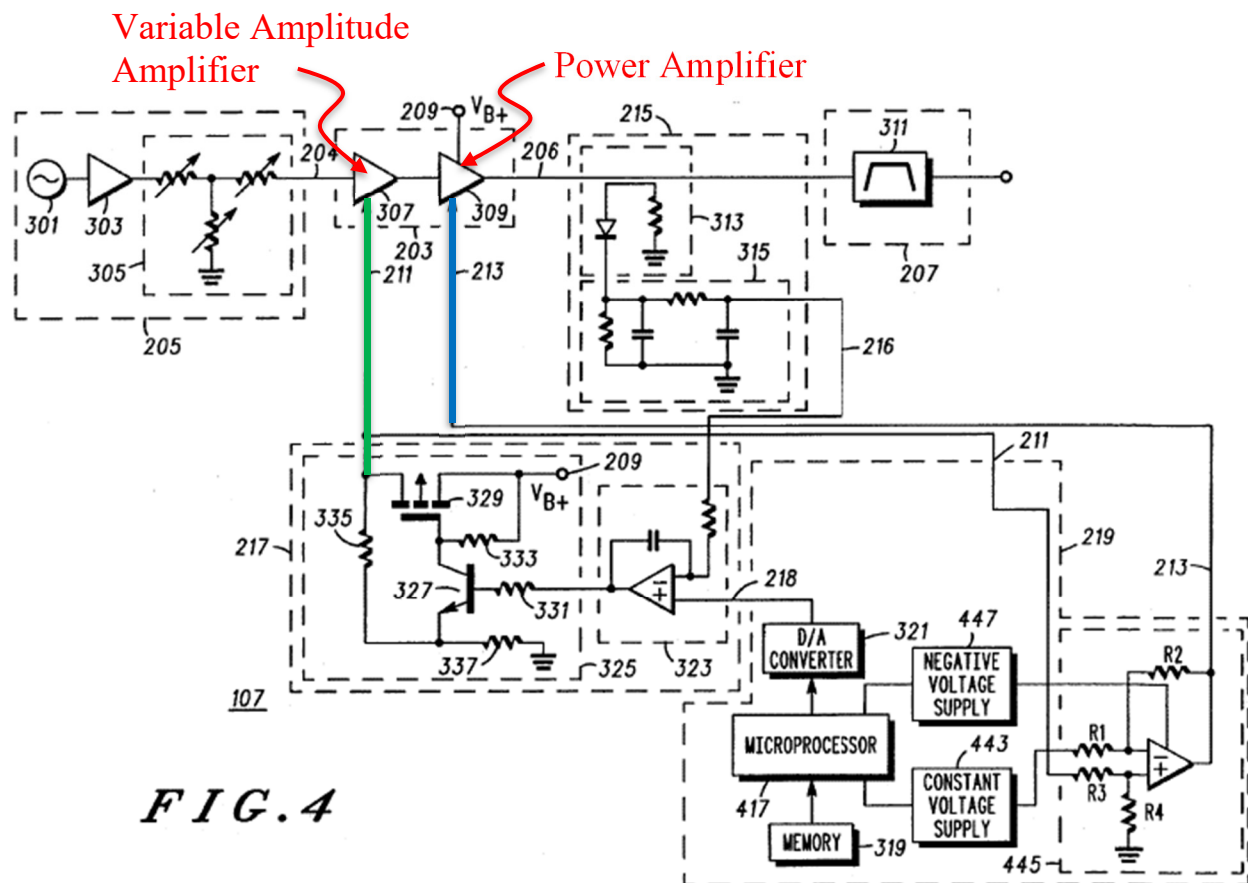
FIG. 3



Ex. 1006 at FIG. 3 (annotated).

125. To the extent that Matero's teachings are considered to not explicitly disclose controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in the memory, such a feature was commonly known in similar prior art methods of controlling a cellular telephone. For instance, Alberth discloses a radiotelephone including a transmitter having amplifying circuitry and control circuitry for controlling the amplifying circuitry. Ex. 1010 at 2:13-37, 3:18-32, 3:39-4:8, 5:11-15, FIGS. 2, 3, 4. FIG. 4 shows the components of the transmitter including the amplifying circuitry 203 and control circuitry. Ex. 1010,

5:11-15.



Ex. 1010 at FIG. 4 (annotated).

126. Alberth discloses that the amplifying circuitry 203 includes a power amplifier driver 307 that is controlled by amplifier control signal 211 (highlighted in green) and a power amplifier 309 that is biased into operation via the application of a gate voltage signal 213 (highlighted in blue):

The RF input signal 204 is coupled to a power amplifier driver 307 that forms an initial stage of the amplifying circuitry 203. The power amplifier driver 307 amplifies the RF input signal 204 to a magnitude dictated by the amplifier control signal 211, which is exclusively

coupled to the power amplifier driver 307. In the preferred embodiment, the power amplifier driver 307, responsive to the amplifier control signal 211, is capable of amplifying the RF input signal 204 from a power level of about +8 dBm to a power level as high as about +17 dBm. A power amplifier 309 is coupled to an output of the power amplifier driver 307 and forms a final stage of the amplifying circuitry 203. Upon receiving the RF input signal 204, now amplified, from the power amplifier driver 307, the power amplifier 309 additionally amplifies the RF input signal 204 to a power level as high as about +30 dBm. The power amplifier 309 is biased into operation via the application of the gate voltage signal 213.

Ex. 1010, 5:38-55 (emphasis added), *see also* 5:66-6:2.

127. Alberth discloses that the amplifier control signal 211 for controlling the gain of the variable amplitude amplifier is determined based on actual power values stored in a memory:

In order to maintain the amount of power in the RF output signal 206 at a constant level, the output power control loop is dependent on the processor circuitry 219 to provide the power output control signal 218. The power output control signal 218, which is comprised of a voltage corresponding to the amount of power that should be contained in the RF output signal 206, is produced by a microprocessor 317, such as a 68HC11 microcontroller available from Motorola, Inc., contained within the processor circuitry 219. First, the microprocessor 317 determines which one of the plurality of predetermined power output levels the transmitter 107 should be operating at by discerning a power

control instruction (not shown) sent by the fixed transceiver 101 (see FIG. 1).

Second, the microprocessor 317 accesses phasing values stored in an associated memory 319 in order to set the voltage of the power output control signal 218. During the manufacture of the radiotelephone 103 phasing values are programmed into the memory 319. The stored phasing values typically consist of the plurality of predetermined power output levels. Each of the plurality of predetermined power output levels are associated with an actual power value that defines the amount of power that should be contained in the RF output signal 206 after amplification in accordance with the particular predetermined power output level. For example, 80(hex) could correspond to 27.5 dBm. The microprocessor 317 is able to retrieve the actual power value from among the phasing values stored in the memory 319 by referencing the predetermined power output level with the power output level dictated by the power control instruction. The microprocessor 317 sets the voltage of the power output control signal 218 to correspond to the retrieved actual power value.

Ex. 1010 at 6:21-54 (emphasis added).

The integrating circuitry 217 controls the amount of power in the RF output signal 206 by varying the amplifier control signal 211 in response to the comparison of the detected power output signal 216 and the power output control signal 218.

Ex. 1010 at 6:63-67 (emphasis added). The actual power values stored in memory and used to determine the amplifier control signal 211 to control the gain of the

variable amplitude amplifier correspond to the claimed “gain data stored in said memory.”

128. Alberth also discloses that the gate voltage signal 213 for biasing the power amplifier is calculated by a function defining a relation of the gate voltage signal 213 and the amplifier control signal 211:

The gate voltage signal 213 is generated by an alternative operational amplifier configuration 445 in direct response to the changing voltage of the amplifier control signal 211 (of the output power control loop).

Ex. 1010 at 8:61-65.

In the preferred embodiment, the alternative operational amplifier configuration 445 is modeled by the following equation (where V_{gate} refers to the voltage of the gate voltage signal 213 $V_{control}$ refers to the voltage of the amplifier control signal 211, and V_{ref} refers to the voltage of as the voltage reference provided by the microprocessor 417):

$$V_{gate} = \frac{V_{control} \times R4}{R3 + R4} - \frac{R2 \times V_{ref}}{R1} + \frac{V_{control} \times R4 \times R2}{R1 \times (R3 + R4)} .$$

Substituting values for the resistors, $R1=R2=R3=10K$ ohms and $R4=1K$ ohms, and the voltage reference, $V_{ref}=4.75$ V, results in the following equation:

$$V_{gate} = V_{control} \times [0.182] - 4.75.$$

Therefore, by making the gate voltage signal 213 dependent on the amplifier control signal 211 in accordance with the aforementioned equation, the amplifying circuitry 203 is able to achieve increased efficiency while maintaining the amount of power in the RF output signal 206 at a constant level.

Ex. 1010 at 9:31-51 (emphasis added), *see also* 7:66-8:3. A POSITA would have recognized that because the function defines a relation of the gate voltage signal 213 and the amplifier control signal 211, and because the amplifier control signal 211 is based on actual power values stored in memory, the function defines a relation of the gate voltage signal 213 and the actual power values stored in memory. Thus, Alberth teaches that the gate voltage signal 213 for biasing the power amplifier is a value based on a corresponding pre-stored value in memory (actual power values) and the detected power output. Ex. 1010 at 3:63-4:3, 6:63-67. Similarly, the '334 patent discloses that values for the bias conditions of the power amplifier are based on predetermined gain values for the variable amplitude amplifier. Ex. 1001 at 6:46-48, 7:34-39.

129. A POSITA would have recognized that the pre-stored set of actual power values has corresponding sets of values for the gate voltage signal 213 because Alberth's gate voltage signal 213 for biasing the power amplifier is a value based on the actual power values stored in memory (and the detected power output), and the same set of values for the gate voltage signal 213 is used to bias the power amplifier each time the corresponding actual power value is accessed from the memory. As a consequence, the same predictable result would have been provided regardless of whether values for the gate voltage signal 213 were pre-stored in memory (like the actual power values) or were generated based on the

actual power values stored in memory. A POSITA would have recognized the known interchangeability of these two traditional options by the relatively late time frame leading up to November 1998. To the extent that Alberth's teachings do not *explicitly* disclose that the bias data is stored in the same memory as the actual power values, a POSITA would have understood that such a solution was not an innovation at the time. Indeed, it would have been a simple substitution of one known option (e.g., Alberth's hardware component that determines the bias data as a relationship to values stored in memory) for another (e.g., memory component that pre-stores the values for the bias data according to the same relationship) to achieve known benefits. For example, a POSITA would have been prompted to use Alberth's memory (already present in the circuit) to store the bias data in addition to the gain data to advantageously reduce the number of hardware components (e.g., hardware used to generate the bias data) in the transmitter and reduce the complexity of the transmitter circuitry, which would further achieve Alberth's suggestion to reduce/optimize power consumption. EX1010, 1:23-25.

130. The combination of Matero (as modified by Ozluturk as described above) and Alberth would result in Matero's mobile station including Alberth's suggestion for controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in memory. Based on my knowledge and experience in

this field and my review of Matero and Alberth, it would have been obvious to a POSITA to combine Matero with Alberth to include, in Matero's mobile station, Alberth's suggestion for controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in memory. Multiple reasons confirm this analysis. *See, infra*, ¶¶132-135.

131. A POSITA would have predictably achieved this result with a reasonable expectation of success. Matero discloses a mobile station including a transmitter having a variable gain amplifier and a power amplifier. Ex. 1006 at 1:6-9, 1:36-45, 2:25-31, FIG. 3. Similarly, Alberth discloses a CDMA mobile station including a transmitter having a variable gain amplifier (e.g., driver 507) and a power amplifier. Ex. 1010 at 2:13-37, 3:18-32, 3:39-4:8, 5:11-15, 5:38-55, 5:66-6:2, FIGS. 2, 3, 4. Matero discloses controlling the transmitter's power that includes controlling the gain of the variable gain amplifier. Ex. 1006 at 4:13-28. Similarly, Alberth discloses controlling the transmitter's power that includes controlling the gain of the variable gain amplifier. Ex. 1010, 5:38-55, 5:66-6:2, 6:21-54, 6:63-67, FIG. 4.

132. Based on my knowledge and experience in this field, a number of reasons would have motivated a POSITA to implement Alberth's suggestion for controlling a gain of the variable amplitude amplifier and a bias condition of the

power amplifier using a function defining a relation between bias data and gain data stored in memory in Matero's mobile station. A POSITA would have recognized the benefits of Alberth's suggestion and would have been motivated to achieve these benefits of Alberth in Matero.

133. As a first reason, a POSITA would have recognized that a radiotelephone developed to optimize power consumption by dynamically varying the bias condition of the power amplifier as a function of the gain of the variable amplitude amplifier results in increased current savings and extending battery life, as expressly stated by Alberth. Ex. 1010 at 1:21-25, 4:26-29, 9:52-62, 11:58-63. A POSITA would have been motivated to achieve these benefits in Matero by controlling Matero's already present variable amplitude amplifier and power amplifier to dynamically vary the bias condition of the power amplifier as a function of the gain of the variable amplitude amplifier so as to increase current savings and optimize power consumption.

134. As a second reason, a POSITA would have been motivated to modify Matero's transmission power control method to include Alberth's suggestion for dynamically varying the bias condition of the power amplifier as a function of the gain of the variable amplitude amplifier. Doing so would advantageously allow Matero's mobile station to increase efficiency of the amplifying circuitry and make it less difficult for the amplifying circuitry to maintain a constant amount of power

in the RF output signal, as stated by Alberth. Ex. 1010 at 2:20-30, 3:27-30, 4:66-5:5, 5:11-15, 7:60-65, 9:15-51, 11:63-12:7.

135. As a third reason, a POSITA would have been prompted to incorporate Alberth's suggestion with Matero's system because doing so would have been a common application of a known technique (e.g., Alberth's suggestion for dynamically varying the bias condition of the power amplifier as a function of the gain of the variable amplitude amplifier) to a known system (e.g., Matero's mobile station that performs transmission power control) ready for improvement to yield predictable results. As discussed above, both Matero and Alberth disclose cellular telephones including a transmitter having a variable amplitude amplifier and a power amplifier. Based upon my knowledge and experience in this field and my review of Matero and Alberth, it is clear that a POSITA would have recognized that applying Alberth's teachings to Matero's mobile station would have led to predictable results, with Matero's mobile station including Alberth's suggestion for controlling a gain of the variable amplitude amplifier and a bias condition of the power amplifier using a function defining a relation between bias data and gain data stored in memory. This implementation (applying Alberth's teachings to Matero's mobile station) would not have significantly altered or hindered the functions performed by Matero's mobile station, and it would have been a relatively straightforward and ordinary task for a POSITA (certainly by the

relatively late time frame leading up to November 1998).

[4.9] in such a manner that said function uses bias conditions defined in a ratio to the maximum bias voltage value and

136. The combination of Matero in view of Alberth provides for controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier in such a manner that the function uses bias conditions defined in a ratio to the maximum bias voltage value. To the extent that Matero's teachings are considered to not explicitly disclose this feature, such a feature was commonly known in similar prior art methods of controlling a cellular telephone. For instance, Alberth discloses biasing the power amplifier to operate close to saturation:

The processor circuitry 219 dynamically varies the negative voltage of the gate voltage signal 213 to cause the amplifying circuitry 203 to operate as close to saturation or as close to, as well as into, class B operation as possible. Class B operation occurs when the operating point of an amplifying element is at an extreme end of its characteristic (i.e., the gate voltage signal 213 is approximately equal to the cutoff voltage defining the saturation point of the amplifying circuitry 203). By controlling the amplifying circuitry 203 such that it operates near saturation, an increase in the efficiency of the operation of the amplifying circuitry 203 is realized in the form of a reduction in current usage.

The processor circuitry 219 controls the amplifying circuitry 203 to sustain operation near saturation by increasing or decreasing the

negative voltage of the gate voltage signal 213. The amplifying circuitry 203 can be considered to be operating near the saturation point when the magnitude of the amplifier control signal 211 is within a predetermined value of the magnitude of the power source 209. By coupling the amplifier control signal 211 and the power source 209 to the processor circuitry 219, the processor circuitry 219 is able to determine if the amplifying circuitry 203 has become too close to the point of saturation and, if so, adjust the negative voltage of the gate voltage signal 213 to a less negative value to prevent saturation. Operating an amplifier in saturation is typically undesired, as damage to some properties of the amplifying elements may occur, subsequently reducing the efficiency of the amplifying circuitry's operation.

While concerned with preventing saturation, the processor circuitry 219 is equally concerned with adjusting the amplifying circuitry 203 to operate as close to the saturation point as possible to achieve increased amplifier efficiency. When the amplifier control signal 211 is not within the aforementioned predetermined value describing the point of saturation, the processor circuitry 219 adjusts the voltage of the gate voltage signal 213 to a more negative value.

Ex. 1010 at 4:18-55 (emphasis added), *see also* 7:51-65. A POSITA would have recognized that the cutoff voltage defining the saturation point of the power amplifier has a corresponding maximum bias value and that each bias value is a ratio of the maximum bias value. Thus, the function defining a relation of the gate voltage signal 213 and the amplifier control signal 211 uses bias values for the gate voltage signal 213 that are defined in a ratio to the maximum bias value

corresponding to the cutoff voltage defining the saturation point of the power amplifier.

137. The combination of Matero (as modified by Ozluturk as described above) and Alberth would result in Matero's control of transmission power including Alberth's suggestion for the function to use bias conditions (e.g., value of the gate voltage signal 213) defined in a ratio to the maximum bias voltage value (e.g., the maximum bias value corresponding to the cutoff voltage defining the saturation point of the power amplifier). Based on my knowledge and experience in this field and my review of Matero and Alberth, it would have been obvious to a POSITA to combine Matero with Alberth to include this feature in Matero's radio telephone and a number of reasons would have motivated a POSITA to implement Alberth's suggestion for the function to use bias conditions (e.g., value of the gate voltage signal 213) defined in a ratio to the maximum bias voltage value (e.g., the maximum bias value corresponding to the cutoff voltage defining the saturation point of the power amplifier) in Matero's radio telephone, as I have explained above in ¶¶130-135.

[4.10] [in such a manner] that said bias condition increases gradually to the maximum value when output intensity increases to the value taken when said cellular telephone is very far from the cell-site station.

138. The combination of Matero in view of Ozluturk and Alberth provides for controlling the gain of the variable amplitude amplifier and the bias condition

of the power amplifier in such a manner that the bias condition increases gradually to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station. For example, Matero discloses that “[a] mobile telephone does not operate with a constant transmitter power level, but is instead transmitter power controlled as a function of ... a distance from a base station.” Ex. 1006 at 1:18-21. A POSITA would have recognized that the transmitter power output intensity increases as the distance between the mobile telephone and the base station increases.

139. Matero also discloses that the radio telephone performs power ramping:

In the digital mode the nominal power levels of 2 through 10 set a control range requirement of 32 dB (the analog mode power level requirements are typically 2-7). Additionally, there should be at least 33 dB reserved for power ramping and transmitter gain variations due to component tolerances and environmental temperature.

Ex. 1006 at 4:29-35.

140. To the extent that Matero’s teachings of power ramping are considered to not explicitly disclose that the bias condition increases gradually to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station, such a feature was commonly known in similar prior art methods of controlling a cellular telephone.

For example, Ozluturk discloses gradually increasing the transmission power level:

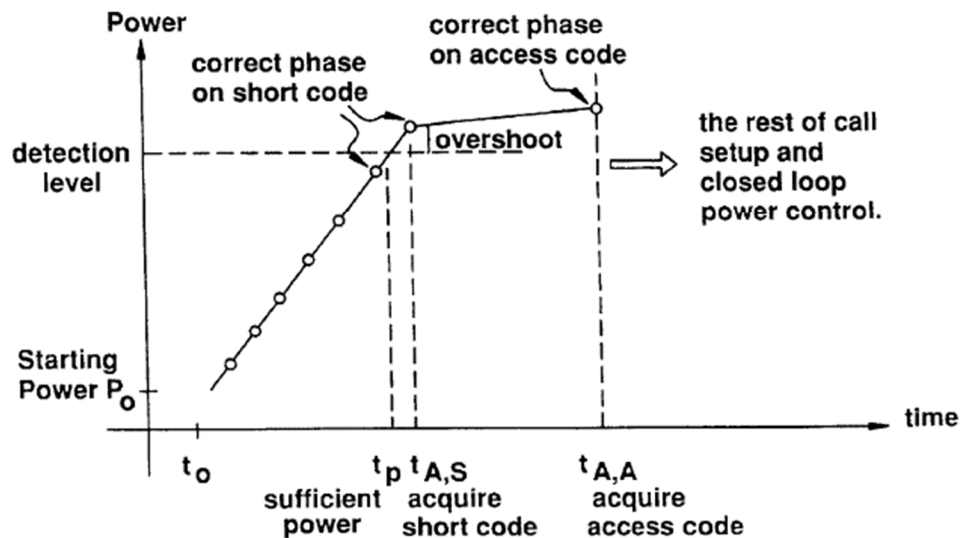
The present invention comprises a novel method of controlling transmission power during the establishment of a channel in a CDMA communication system by utilizing the transmission of a short code from a subscriber unit to a base station during initial power ramp-up. The short code is a sequence for detection by the base station which has a much shorter period than a conventional spreading code. The ramp-up starts from a power level that is guaranteed to be lower than the required power level for detection by the base station. The subscriber unit quickly increases transmission power while repeatedly transmitting the short code until the signal is detected by the base station. Once the base station detects the short code, it sends an indication to the subscriber unit to cease increasing transmission power.

Ex. 1008 at 3:7-20, *see also* 5:54-59, 6:44-59, 7:53-59, 10:11-41.

In the preferred embodiment of the present invention, the power ramp-up rate using the short code is 1 dB per millisecond. The base station 14 subsequently transmits a short code detection indication signal (step 164) to the subscriber unit 16 which enters the second stage of the power ramp-up upon receiving this indication. In this stage, the subscriber unit 16 ceases transmitting the short code (step 166) and starts continuously transmitting a periodic access code (step 1.66). The subscriber unit 16 continues to ramp-up its transmission power while transmitting the access code, however the ramp-up rate is now much lower than the previous ramp-up rate used with the short code (step 168). The ramp-up rate with the access code is preferably 0.05 dB per millisecond.

Ex. 1008 at 8:18-30. Ozluturk's FIG. 7 shows the transmission power increasing gradually to the maximum value.

FIG.7



Ex. 1008 at FIG. 7. The combination of Matero and Ozluturk teaches that the transmission power output intensity gradually increases to a value taken when the cellular telephone is very far from the cell-site station.

141. In addition, Alberth discloses that the gate bias control loop, which dynamically varies the gate voltage signal 213 for biasing the power amplifier, “may be executed every time there is a power level change, a channel change, or an initial power-up of the radiotelephone.” Ex. 1010 at 4:14-17, 4:56-65. Alberth also discloses increasing the bias condition to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station:

If the radiotelephone 103 struggles to maintain communication with the transceiver 101 (see FIG. 1) due to lack of proximity therewith or obstruction by natural or manmade structures positioned therebetween, the processor circuitry 219 may control the transmitter 107 to boost power. For example, when the cellular radiotelephone 103 is operating at, or outside of, the boundary of coverage of the transceiver 101 (which has no bordering transceiver), the radiotelephone 103 may momentarily boost power above the largest one of the plurality of the predetermined power output levels to maintain communication with the transceiver 101. When such conditions occur, the processor circuitry 219 proceeds to step 611 and enters the power boost mode.

The power boost mode of step 611 causes a momentary increase in the amount of power in the RF output signal 206. This is accomplished through an increase of the power output control signal 218 by the processor circuitry 219, which, in turn, causes an increase in both the amplifier control signal 211 and the amplification of the amplifying circuitry 203.

Ex. 1010 at 11:23-42 (emphasis added). As discussed above in the analysis of element [4.8], Alberth discloses that the gate voltage signal 213 for biasing the power amplifier is calculated as a function of the amplifier control signal 211:

The gate voltage signal 213 is generated by an alternative operational amplifier configuration 445 in direct response to the changing voltage of the amplifier control signal 211 (of the output power control loop).

Ex. 1010 at 8:61-65, *see also* 7:66-8:3, 9:31-51. Because Alberth discloses that an increase in the amount of power in the RF output signal due to lack of proximity to

a base station is accomplished through an increase in the amplifier control signal 211 which causes an corresponding increase in the gate voltage signal 213, Alberth discloses controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier in such a manner that the bias condition increases to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station.

142. The combination of Matero, Ozluturk, and Alberth would result in Matero's control of transmission power including Ozluturk's suggestion for gradually increasing the transmission power to a value taken when said cellular telephone is very far from the cell-site station and Alberth's suggestion for controlling the bias condition such that the bias condition increases to the maximum value when the transmission power output intensity increases to the value taken when said cellular telephone is very far from the cell-site station. The resulting combination would result Matero's control of transmission power including a gradual increase of the transmission power output intensity (as suggested by Ozluturk) accomplished through a gradual increase in the gain of the variable amplitude amplifier which causes an corresponding gradual increase in the bias condition of the power amplifier (as suggested by Alberth) to a maximum value when output intensity increases to the value taken when said cellular telephone is very far from the cell-site station (as suggested by Matero and

Alberth). Based on my knowledge and experience in this field and my review of Matero, Ozluturk, and Alberth, it would have been obvious to a POSITA to combine Matero, Ozluturk, and Alberth to include the feature of controlling the gain of the variable amplitude amplifier and the bias condition of the power amplifier in such a manner that the bias condition increases gradually to the maximum value when output intensity increases to the value taken when the cellular telephone is very far from the cell-site station in Matero's radio telephone and a number of reasons would have motivated a POSITA to implement Ozluturk's suggestion for gradually increasing the transmission power to a value taken when said cellular telephone is very far from the cell-site station and Alberth's suggestion for controlling the bias condition such that the bias condition increases to the maximum value when the transmission power output intensity increases to the value taken when said cellular telephone is very far from the cell-site station in Matero's radio telephone, as I have explained above in ¶¶103-108, 123, 130-135.

[6] A method according to claim 4 wherein said bias condition increases gradually to the maximum value when said output intensity increases within the range of -50 dB to 0 dB.

143. Matero in view of Ozluturk and Alberth provides that the bias condition increases gradually to the maximum value when the output intensity increases within the range of -50 dB to 0 dB. As discussed above in the analysis of

element [4.10], the combination of Matero in view of Ozluturk and Alberth provides that the bias condition increases gradually to the maximum value when the output intensity increases. *See ¶¶138-142 above.* Matero further discloses a transmission power control range of 60 dB:

More particularly, this invention teaches a transmitter circuit for use in a radio telephone, the transmitter circuit including a power amplifier having an output coupled to an antenna for transmitting an amplified modulated RF signal; a variable gain driver amplifier having an output coupled to an input of the power amplifier and an input coupled to an output of a modulator, the variable gain driver amplifier being required to output the modulated RF signal within a predetermined dynamic power range having a maximum value; and at least one programmable gain amplifier coupled in series between the output of the modulator and the input of the variable gain driver amplifier. The at least one programmable gain amplifier has a dynamic range selected for reducing the dynamic range requirement of the variable gain driver amplifier to be less than the predetermined dynamic power range. For example, the maximum predetermined dynamic range value is in excess of 60 dB, and a maximum dynamic range value of the variable gain driver amplifier is less than 50 dB (e.g., 40 dB to 44 dB).

Ex. 1005 at 2:25-43 (emphasis added). Because Matero teaches a transmission power control range of 60 dB which is greater than 50 dB, Matero in view of Ozluturk and Alberth teaches that the bias condition increases gradually to the maximum value when the output intensity increases within the range of -50 dB to 0

dB.

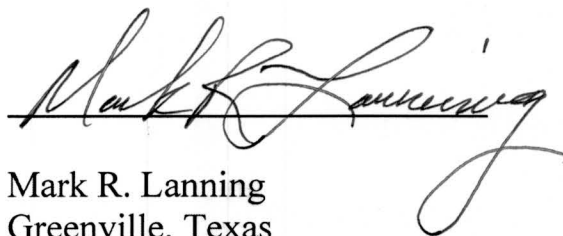
144. For at least these reasons, it is clear that a POSITA would have recognized that the teachings of Matero in view of Ozluturk and Alberth provide all elements of claims 4 and 6 of the '334 patent.

X. ADDITIONAL REMARKS

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

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

Dated: 1/16/2019

By: 
Mark R. Lanning
Greenville, Texas

Curriculum Vitae

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Mark R. Lanning

Mark is currently the President of Telecom Architects, Inc., I.N. Solutions, Inc.¹ and Reticle Consulting, LLC. Each of these companies provides professional consulting services and custom software development for one or more particular technical areas. I.N. Solutions (Intelligent Networking Solutions) was established in 1991 with an emphasis on applications design and network architecture engineering for telephone-based switching and Advanced Intelligent Networking systems. Telecom Architects was established in 1999 to provide specialized consulting services to fixed and wireless telecom service providers and their equipment suppliers. Reticle Consulting was created in 2009 to provide specialized consulting services for forensic software analysis and software source code comparison for software misappropriation cases.

Mark has over 35 years of engineering experience in all the development life cycle phases for hardware and software products. He has worked with both network operators and product suppliers regarding network architectures and product development and has acquired key insights into their perspectives and requirements as both suppliers and customers.

While working for three different product suppliers, Mark was directly responsible for the design, development and rollout of new products that have earned combined revenues in excess of one billion dollars for their respective companies. These products include: the DSC/Alcatel Signal Transfer Point (STP) product; the Telinq/ADC M13 transmission multiplexer and analyzer products; and the Tandem/HP Service Control Point (SCP), Service Management System (SMS); Service Creation Environment (SCE) products and their applications.

Since starting I.N. Solutions in 1991, Mark has worked with Motorola, Sprint, Nextel, and British Telecom (BT) to roll out some of the most successful telecom applications and network expansions worldwide. Mark was directly involved in the design of Sprint's Common Channel Signaling System 7 (SS7) network and the design and rollout of its FON (calling card) and 800 number services. Mark was the program manager responsible for the design and rollout of BT's Advanced Cellular Network (ACN) that used AIN functionality. BT's ACN was one of the largest cellular networks in the world and also includes advanced corporate virtual private network (VPN) and pre-pay validation services. Starting in 1998, Mark and the Telecom Architects (TAI) team were contracted by Nextel to design their 2.5G cellular iDEN switching, VoIP dispatch network² and its TDM/SONET transmission networks. After completion of the 2.5G network design, Mark and the TAI team performed a large part of the qualification, testing and rollout phases for new equipment suppliers and their applicable products into Nextel's network.

Before starting his own consulting company in 1991, Mark was initially employed as individual contributor on both hardware and software development projects, later worked as a manager on hardware and software development groups that varying in size from 5-20 engineers and eventually held several executive management positions with responsibility of over 200 engineers.

Hardware and Software Development Experience

Mark's hardware and software experience began in 1974 while in the US Army Signal Corps. Mark was initially trained as a hardware technician on data and voice crypto (encrypted transmission) communications equipment. After achieving the "top graduate" award at three different hardware and

¹ I.N. Solutions Inc. is no longer active.

² Also referred to as the Nextel push-to-talk or walkie-talkie feature that did not require a voice bearer channel.

software training schools, Mark received a Top Secret security clearance and was transferred to the Army Security Agency (ASA). His assignment with the ASA included joint software development with the National Security Agency (NSA) and the white house communications staff. The software development was done on “state of the art” computer and communication systems built by DEC and GE using assembly language.

From 1978-1983, Mark worked as both a hardware and software development engineer for IT&T Defense Communications. The majority of his time was spent on building a new store and forward message switching system that was used by the white house, US embassies worldwide and two major US airlines. DEC PDP-11 and PDP-15 computers were coupled together and operated in conjunction with custom IT&T hardware for this system. The system architecture was traditional mini-computer architecture with sixteen front-end communications computers to interface with hundreds of modems and perform various communications protocols. The software was written in DEC assembly language. Many different types of communications protocols and state of the art modems were used with this system.

In 1983, Mark was hired as hardware and software development engineer by Digital Switch Corporation (now a part of Alcatel) and was later promoted to design and development manager responsible for their initial SS7 protocol and Signal Transfer Point (STP) products. The STP product performed packet switching for thousands of messages per second between telephone switches for the purpose of connecting normal phone calls worldwide and support of advanced telephony services. The STP was designed to have a fault tolerant hardware and software architecture to provide 24x7 operation and provided interfaces to various telephone company management and support systems. A typical configuration of the STP product included at least 200 separate microprocessor boards working in a closely coupled distributed system architecture. Communications between the processors was performed over parallel hardware buses using DSC’s proprietary operating system. Mark was also responsible for development of all the communication protocols the STP would require to communicate with other switching, operations and administration systems. These protocols were X.25, X.75, SS7 MTP/SCCP/TCAP and FTP. The hardware used was Zilog Z-8000 and Motorola 68xxx family microprocessors. The software was written in assembly and C languages.

In 1985, Mark was hired by Telinq Inc. (now part of ADC) as their director of software development and was later promoted to vice president of hardware and software development. Telinq was a venture capital start-up company and their initial two products were high speed digital TDM transmission multiplexers and analyzers mainly used by telecom network operators and service providers. The hardware consisted of multiple Motorola 68xxx family processors replicated different types of custom designed high-speed gate arrays. The software was distributed and written in C and assembly language.

In 1987, Mark joined the Telecom Division of Tandem Computers, Inc. (now part of HP) as their Vice President of hardware and software development. Tandem Telecom was a new division that built products for telephone companies that leveraged its fault tolerant Guardian and Unix based computer systems. The initial products built under Mark’s direction were a Service Control Point (SCP), Service Management System (SMS) and Service Creation Environment (SCE). Although these product names are unique to Intelligent Networking telephony systems, they use state of the art hardware and software to perform many standard functions. The SCP system performs on-line transaction processing for the telephone switches in a network. These transactions support phone company services like 800 number translation, calling card number validation and home location register (HLR) functionality for cellular networks. The SCP was a fault tolerant multiple processor system capable of supporting hundreds of

globally located nodes with multiple processors in each node. Each SCP required specialized communications software and hardware that was build by Tandem Telecom. The full suite of commercial communications software was supported including X.25, TCP/IP and SS7. The software was written in C, C++ and assembly language. The SMS system was build to manage multiple SCP systems, update the software applications and keep their multi-million record databases synchronized. The SMS software was written in C and C++. The SCE was telephone service authoring tool used by telephone company personnel to modify or create new services on their network without requiring them to be intimately familiar with the underlying system or detailed programming. The SCE software ran on Unix or PC Windows operating systems and was written in C++ and C and the most advanced software development workbench software.

Program and Project Management Experience

Mark has been directly involved with formal project management concepts and tools since 1984. Most, if not all, the projects listed above were managed using project management concepts and tools. The main techniques used for these projects were PERT and CPM. Mark either generated the initial PERT chart and staff assignments for each project or was directly involved in defining the program logic and assignments to be used. Since 1984, every project that Mark has been responsible for has included formal product life cycle documentation, requirements tracking, problem reporting and resolution.

Since 1991, Mark has been responsible for some large development and network architecture projects with a budget in excess of \$100 million each. Two of these projects were for British Telecom's cellular network division called Cellnet. The initial project, ACN, was an on-line transaction processing (OLTP) system responsible for real-time dialed digit translation for every phone call in the Cellnet network and was required to perform thousands of transactions per second. The second project replaced Cellnet's batch-oriented billing system with a distributed real-time call detail record collection and on-demand rating and billing system. Both of these systems required custom development for a majority of the software that was done by different companies located across multiple countries and continents. The ACN project lasted about four years and involved over 100 software development personnel located in Texas, Nebraska, California, Sweden, Spain, Finland and England. The billing system project lasted more than three years and required over 600 developers at its peak that were located in England, Colorado, Texas and Sweden. Both of these systems were 24x7 mission critical to completing wireless calls and billing.

Mark and members of the Telecom Architects group have developed innovative methods for requirements definition, design, modeling and documentation of large telecommunications networks. Some of this methodology has been published by Wireless Review Magazine.

In 1977 and 1978 Mark obtained a Private Pilot, Commercial, Instrument, and Flight Instructor ratings.

Mark received a BS in Computer Science degree from Southern Methodist University in 1983 and has been a visiting lecturer at SMU on various data and voice telecommunications subjects.

Industry Memberships

Member of IEEE and IEEE Standards Association.

Member of ACM (Association for Computing Machinery).

Telecom Standards Definition

Mark is one of the Advanced Intelligent Network (AIN) and Signaling System Number 7 (SS7) pioneers. He was a contributing member of the first ANSI T1X1 standards group that defined and approved the initial North American AIN and SS7 requirements and was actively involved with this group for three years. These standards were later adopted by the ITU.

Telephony Systems

Mark has been directly involved with the development and/or detailed functional analysis of the following systems: DSC/Alcatel DEX-STP, DEX-400, DEX-600 and MegaHub circuit switches; Nortel DMS circuit switch for class IV and MSC applications; Ericsson AXE circuit switch for class IV, MSC and HLR applications; Lucent's 5ESS circuit switch in class IV, class V and MSC applications; Tandem/HP SCP, SMS, SCE and HLR.

Mark has also been intimately involved with the design, analysis and/or network implementation of many different PSTN and cellular network elements including at least: MSC, VLR, HLR, BSC, BTS, SMSC, MMSC, GGSN/SGSN, eNodeB, and RNC.

Network Design Experience Summary

Mark has extensive telecommunications network design experience for both North American and European fixed and wireless networks. He has participated in the creation of RFIs and RFPs and the evaluation of supplier responses; negotiated supplier equipment contracts; written requirements for custom hardware and software features and has led engineering teams in the design and rollout of new networks and network expansions. These network designs included LANs, WLANs, WANs, TDM and SONET transmission networks, signaling system 7 (SS7) networks, ATM/IP data switching/routing, mission critical on-line transaction processing enterprise networks and voice switching networks using traditional circuit switches, soft switches and media gateways.

Software Development Languages and Tools

Assembly language for DEC PDP-11, PDP-15, Zilog Z-80 & Z-8000, and Motorola 68xxx processors.

Fortran IV and Fortran 77.

Cobol.

Pascal.

Basic and Visual Basic

C and C++

X Windows, Motif and SmallTalk Toolkits

Microsoft Office FrontPage

Java and JavaScript

Publications

Mark Lanning and David Sanders, "In Sync" Wireless Review. January 15, 2000.

Technical Expert Experience (At least all cases filed after 1/1/2013)

InterDigital Communications Corporation v. Samsung et al. Investigation No. 337-TA-868 (Initiated 01/2013). Before the United States International Trade Commission in Washington, D.C. Patent infringement case regarding 3G and/or 4G wireless devices. On behalf of ZTE and Huawei. Provided deposition and hearing testimony.

Freescale Semiconductor, Inc. v. Maxim Integrated Products, Inc. and Tanju Yurtsever. C.A. No. 1:13-CV-00075-LY (Filed 01/18/2013). Before the United States District Court for the Western District of Texas. Copyright infringement and misappropriation of trade secrets case regarding software for manufacturing semiconductors. On behalf of Freescale Semiconductor.

Wi-LAN USA, Inc. et al v. Apple Inc. C.A. No. 3:13-CV-00798-DMS-BLM. Before the United States District Court, Southern District of California in San Diego. Patent infringement case regarding 3G and/or 4G wireless devices. On behalf of Apple.

Mobile Telecommunications Technologies, LLC (MTEL) v. Apple Inc. C.A. No. 2:13-CV-258. Before the United States District Court for the Eastern District of Texas, Marshall Division. Patent infringement case regarding Wi-Fi and cellular devices. On behalf of Apple. Provided deposition and trial testimony.

Solocron Media, LLC v. Verizon Communications Inc., et al. C.A. No. 2:13-CV-1059. Before the United States District Court for the Eastern District of Texas, Marshall Division. Patent infringement case regarding wireless devices. On behalf of Verizon. Provided IPR declarations and expert report.

DataQuill Limited v. Huawei Technologies Co. Ltd., et al. C.A. No. 2:13-CV-633-JRG-RSP. Before the United States District Court for the Eastern District of Texas, Marshall Division. Patent infringement case regarding wireless devices. On behalf of Huawei and AT&T.

Intellectual Ventures I LLC v. United States Cellular Corporation, C. A. No. 1:13-cv-1672-LPS;
Intellectual Ventures II LLC v. United States Cellular Corporation, C. A. No. 1:14-cv-1233-LPS;
Intellectual Ventures I LLC v. AT&T Mobility LLC et al., C. A. No. 1:13-cv-01668-LPS;
Intellectual Ventures II LLC v. AT&T Mobility LLC et al., C. A. No. 1:14-cv-1229-LPS;
Intellectual Ventures I LLC v. Cricket Communications, Inc., C. A. No. 1:13-cv-1669-LPS;
Intellectual Ventures II LLC v. Cricket Communications, Inc., C. A. No. 1:14-cv-1230-LPS;
Intellectual Ventures I LLC v. Nextel Operations, Inc. and Sprint Spectrum L.P., C. A. No. 1:13-cv-1670-LPS;
Intellectual Ventures II LLC v. Nextel Operations, Inc. and Sprint Spectrum L.P., C. A. No. 1:14-cv-1231-LPS;
Intellectual Ventures I LLC v. T-Mobile USA, Inc. and T-Mobile US, Inc., C. A. No. 13-cv-1671-LPS;
Intellectual Ventures II LLC v. T-Mobile USA, Inc. and T-Mobile. All cases are before the United States District Court for the District of Delaware. Patent Infringement cases regarding cellular networks and/or devices. On behalf of Ericsson.

InterDigital Communications Corporation v. Huawei Technologies Co. Ltd. Arbitration before the International Court of Arbitration. Patent licensing and analysis of ETSI Standard Essential Patents for UMTS and LTE. On behalf of Huawei. Provided testimony at deposition and hearing.

Inter Partes Reviews for Intellectual Ventures LLC's U.S. Patent Nos. 8,310,993; 7,385,994; 6,640,248; and 6,023,783. On behalf of Ericsson. Provided deposition testimony.

Genband U.S. LLC v. Metaswitch Networks Ltd and Countersuit. C.A. No. 2:14-CV-33, 2:14-CV-744 and 2:16-cv-582. Before the United States District Court for the Eastern District of Texas in Marshall. Patent infringement case regarding Internet and switching devices. On behalf of Genband. Provided testimony for multiple depositions and multiple trials.

Intellectual Ventures I LLC and Intellectual Ventures II LLC v. Capital One. C.A. No. 8:14-cv-00111. Before the United States District Court for the District of Maryland. Patent Infringement case regarding banking applications on cellular devices. On behalf of Capital One.

Comcast Cable Communications LLC, et al. v. Sprint Communications Company L.P., et al. C.A. No. 2:12-cv-0859. Before the United States District Court for the Eastern District of Pennsylvania. Patent infringement case regarding cellular networks and/or devices. On behalf of Sprint. Provided deposition and trial testimony.

LM Ericsson, et al. v. Wi-LAN USA, Inc. et al. C.A. No. 1:14-21854. Before the United States District Court for the Southern District of Florida. Contract dispute regarding cellular network equipment licensing. On behalf of Ericsson.

Intellectual Ventures I LLC et al. v. AT&T Mobility LLC et al. C.A. No. 12-cv-193 (Filed 2/16/2012). Before the United States District Court for the District of Delaware. Patent infringement case regarding cellular messaging. On behalf of AT&T Mobility, Sprint, T-Mobile, and U.S. Cellular. Provided deposition testimony.

OptumSoft, Inc. v. Arista Networks, Inc. C.A. No. 114CV263257. Before the Superior Court of California, County of Santa Clara. Contract dispute regarding ownership of software for telecommunications equipment. On behalf of Arista Networks, Inc. Provided deposition and trial testimony.

Transverse, LLC v. Info Directions, Inc. d/b/a IDI Billing Solutions. In the Iowa District Court for Polk County. Trade secret misappropriation case regarding cellular billing software. On behalf of Transverse. Provided testimony for multiple depositions.

KPN N.V. v. Samsung Electronics America, Inc. et al. C.A. No. 2:14-cv-1165. Before the United States District Court for the Eastern District of Texas, Marshall Division. Patent infringement case regarding cellular devices. On behalf of Samsung.

Core Wireless v. LG Electronics, Inc. and LG Electronics MobileComm U.S.A., Inc. C.A. No. 2:14-cv-911 (lead case) and C.A. No. 2:14-cv-912 (consolidated). Before the United States District Court for the Eastern District of Texas, Marshall Division. Patent infringement case regarding cellular networks and/or devices. On behalf of LG. Provided deposition and trial testimony.

Wireless Protocol Innovations v. TCT Mobile (US) Inc. et al. C.A. No. 6:15-cv-00918. Before the United States District Court for the Eastern District of Texas, Tyler Division. On behalf of TCT Mobile. Provided deposition testimony.

Cellular Communications Equipment LLC (Acacia) v. T-Mobile USA, Inc. et al. C.A. No. 2:15-cv-00576, 2:15-cv-00579, 2:15-cv-00580, and 2:15-cv-00581. Before the United States District Court for the Eastern District of Texas, Marshall Division. On behalf of Ericsson.

Huawei Technologies Co. Ltd. v. T-Mobile USA Inc., Nokia Solutions and Networks, et al. C.A. Nos. 2:16-cv-00052 and 2:16-cv-00056. Before the United States District Court for the Eastern District of Texas, Marshall Division. On behalf of Nokia & Cisco. Provided deposition testimony.

Nokia Solutions and Networks US LLC, et al. v. Huawei Technologies Co. LTD., et al. C.A. Nos. 2:16-CV-00753, 754, 755 and 756. Before the United States District Court for the Eastern District of Texas, Marshall Division. On behalf of Nokia.

Sycamore IP Holdings LLC v. AT&T Inc. et al. C.A. No. 2:16-cv-00588. Before the United States District Court for the Eastern District of Texas, Marshall Division. On behalf of AT&T. Provided deposition testimony.

Apple Inc. v. Wi-LAN Inc. C.A. No. 3:14-cv-02235 and Wi-LAN Inc. v Apple Inc. C.A. No. 3:14-cv-01507 (Filed June 2014). Before the United States District Court for the Southern District of California in San Diego. On behalf of Apple. Provided deposition and trial testimony.

Bascom Global Internet Services Inc. v. AT&T Inc. C.A. No. 3:14-cv-03942. Before the United States District Court for the Northern District of Texas in Dallas. On behalf of AT&T. Case active as of 08/01/2018.

Apple Inc. v. Qualcomm Inc. C.A. No. 3:17-cv-00108. Before the United States District Court for the Southern District of California in San Diego. On behalf of Apple. Case active as of 08/01/2018.

Koninklijke KPN NV. v. TCL Corporation et al. C.A. No. 1:17-cv-00091. Before the United States District Court for the District of Delaware. On behalf of TCL.

Blackberry Limited, et al. v. Avaya Inc. C.A. No. 3:16-cv-2185. Before the United States District Court for the Northern District of Texas in Dallas. On behalf of Avaya.

Alacritech Inc. v. Dell Inc. C.A. No. 2:16-cv-00695. Before the United States District Court for the Eastern District of Texas, Marshall Division. On behalf of Intel. Provided deposition testimony.

Plectrum LLC v. AT&T Mobility LLC. C.A. No. 4:17-cv-120. Before the United States District Court for the Eastern District of Texas in Sherman. On behalf of AT&T.

Securus Technologies Inc. v. Global Tel*Link Corporation. C.A. No. 3:16-cv-01338. Before the United States District Court for the Northern District of Texas in Dallas. On behalf of Securus.

Intellectual Ventures I, LLC and Intellectual Ventures II, LLC v. Ericsson. C.A. No. 1:14-cv-01233-LPS. Before the United States District Court for the District of Delaware. On behalf of Ericsson.

Iridescent Networks, Inc. v. AT&T Mobility LLC and Ericsson Inc., C.A. No. 6:16-CV-1003-RWS-JDL. Before the United States District Court for the Eastern District of Texas in Tyler. On behalf of AT&T. Case active as of 08/01/2018.

Network Managing Solutions, LLC v. AT&T Mobility, LLC. C.A. No. 1:16-cv-00295-RGA (Filed April 2016). _Before the United States District Court for the District of Delaware. On behalf of AT&T Mobility. Case active as of 08/01/2018.

Barkan Wireless IP Holdings, L.P. v. Samsung and Verizon. C.A. No. 2:18-cv-28-JRG. Before the United States District Court for the Eastern District of Texas, Marshall Division. On behalf of Samsung and Verizon. Case active as of 08/01/2018.

Genband U.S. LLC and Sonus Networks, Inc. v. Metaswitch Networks Ltd and Countersuit. Cause No. DC-17-03697. Before the District Court of Dallas County, Texas, 134th Judicial District. Case regarding Internet and switching devices. On behalf of Genband. Case active as of 08/01/2018.