UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZTE (USA) INC.,
Petitioner,

v.

WSOU INVESTMENTS LLC D/B/A BRAZOS LICENSING AND DEVELOPMENT,
Patent Owner.

IPR2023-00500
U.S. Patent 7,477,876

DECLARATION OF STEPHEN GRAY IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT 7,477,876

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1. 9[preamble]: “A method for adapting the rate of reporting channel quality information in a wireless communication system including at least one base station and at least one mobile station, the method comprising:”.....48

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3. 9[b]: “in the presence of a reception of a data transmission at the at least one mobile station, adapting the rate for reporting channel quality information from the at least one mobile station to the at least one base station from the first rate to a second rate for a prescribed duration.”.....49

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B. Claim 6: "The method according to claim 5, wherein the transmission format includes one or more parameters selected from the group consisting of modulation format, number of codes, and transmission rate." 55

C. Claim 8: "The method according to claim 1, wherein the channel quality information comprises a transmission rate calculated by the mobile station based on one or more channel conditions." 55

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I. INTRODUCTION

1. I, Stephen Gray, submit this declaration to state my opinions on the matters described below.

2. I have been retained by Petitioner, ZTE (USA) Inc., as an independent expert for the above-identified *inter partes* review proceeding involving U.S. Patent No. 7,477,876 ("the '876 patent"). Although I am being compensated for my time in connection with this IPR at my standard hourly consulting rate and reimbursed for reasonable out-of-pocket expenses, no part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding.

3. I have been asked to provide my technical review, analysis, highlights, insights, and opinions regarding the '876 Patent and the above-noted references that form the basis for the invalidity grounds set forth in the Petition for *Inter Partes* Review of the '876 Patent.

II. QUALIFICATIONS

4. Based upon my educational and work experience, I believe I am well qualified to serve as a technical expert in this matter. And my testimony is set forth in this declaration.

5. I received a B.S. degree in Economics from California Polytechnic University in 1973.

6. I have over thirty years of experience in the computer and communications industries. My background includes systems and software architecture, design and development, as well as senior management positions in development, marketing, and general management.

7. As described in my curriculum vitae ("CV") (Ex. 1004), I have extensive experience in the field of communications, such as wireless communications.

8. I defined, designed, and implemented telecommunications control devices for Computer Communication Incorporated.

9. I developed and presented numerous public and in-house courses in IBM, Unix, Internet and related operating system and networking technologies.

10. I was CSO for a Business Process Management software startup. The firm develops Web Services/SOA based BPM creation, orchestration, management and optimization solutions.

11. I was CTO for an e-Commerce Internet startup. The firm developed a product that specializes in procurement for public agencies.

12. I was Interim CEO for a broadband Competitive Local Exchange Carrier (CLEC), and helped negotiate the successful sale of the CLEC.

13. I was the CTO for an Internet-based secure content distribution startup. The firm developed comprehensive Digital Rights Management (DRM) solutions for the control and promotion of content on the Internet.

14. I participated in the architecture definition and design of a highly scalable, high-performance device controller for multifunction document processing products.

15. I have performed a detailed analysis of the competitive environment for retail point-of-sale hardware and software systems. Analysis included technology, marketing, compensation, and back-office interface issues.

16. I have provided system design, product selection and project management for a turnkey software/hardware system for residential refuse hauling and toxic waste disposal company.

17. I have led the design of a high-performance, LAN-based image capture and statement printing subsystem.

III. MATERIALS CONSIDERED

18. In forming my opinions, I have reviewed the following documents and any other documents cited in this declaration:

Exhibit	Description
Ex. 1001	U.S. Patent No. 7,477,876 ("the '876 patent")
Ex. 1002	Prosecution History of the '876 patent
Ex. 1005	U.S. Patent No. 6,453,151 ("Kiang")
Ex. 1006	U.S. Patent Publication No. 2004/0013103 ("Zhang")
Ex. 1007	U.S. Provisional Application No. 60/301,312 ("Zhang Provisional")
Ex. 1008	U.S. Patent No. 5,541,955 ("Jacobsmeyer")
Ex. 1009	U.S. Patent No. 6,252,854 ("Hortensius")
Ex. 1010	U.S. Patent Publication No. 2001/0034236 ("Tong")
Ex. 1011	U.S. Patent No. 6,741,862 ("Chung")

IV. RELEVANT LEGAL STANDARDS

19. In preparing this declaration and forming my opinions, I am relying on certain legal principles that counsel explained to me. My understanding of these concepts is summarized below.

20. I have been asked to provide my opinions regarding whether claims 1–13 ("the Challenged Claims") of the '876 Patent are unpatentable, either because they are anticipated or would have been obvious to a person having ordinary skill in the art at the time of the alleged invention, in light of the prior art. I have been advised and understand that prior art includes all analogous art, and

that two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. It is my opinion that the Challenged Claims would have been obvious to a person having ordinary skill in the art at the time of the '876 Patent invention.

21. In forming my opinions expressed below in addition to my knowledge and experience based upon my work in the telecommunications field and as described below, I have considered the documents listed in the Table in Section III above.

22. I have been advised and understand that a dependent claim is a patent claim that refers back to another patent claim. I have been informed and understand that a dependent claim includes all of the limitations of the claim to which it refers.

23. I have been advised and understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can "anticipate" the claim. Second, the prior art can make the claim "obvious" to a person of ordinary skill in the art. I understand that for an invention claimed in a

patent to be patentable, it must not be anticipated and must not be obvious based on what was known before the invention was made.

24. I have been advised and understand that a patent claim is unpatentable as anticipated under 35 U.S.C. § 102 if each element of that claim is present either explicitly or inherently in a single prior art reference. I have also been advised and understand that, to be an inherent disclosure, the prior art reference must necessarily disclose the limitation. The fact that the reference might practice or contain a claimed limitation is insufficient to establish that the reference inherently teaches the limitation.

25. I have been advised and understand that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. I have also been advised and understand that the obviousness analysis takes into account factual inquiries, including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

26. I have further been advised and understand that the Supreme Court has recognized several rationales for combining references or modifying a

reference to show obviousness of claimed subject matter. Some of these rationales include the following: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

27. When considering the issue of obviousness, I have been advised and understand that I should consider (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) evidence of secondary indicia of nonobviousness. I have been informed that secondary indicia of nonobviousness 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.

A. Level of Ordinary Skill in the Art

28. In rendering the opinions set forth in this declaration, I have been asked to consider the ’876 Patent’s claims and the prior art through the eyes of a person of ordinary skill in the art. I understand that a person of ordinary skill in the art is determined by considering (1) the type of problems encountered in the art, (2) prior art solutions to those problems, (3) the rapidity with which innovations are made, (4) the sophistication of the technology, and (5) the educational level and years of experience level of those working in the pertinent field.

29. I have been informed that a person or ordinary skill in the art is a hypothetical person as of November 2, 2001, to whom an expert in the relevant field could assign a routine task with reasonable confidence that the task would be successfully carried out. I have been informed that evidence of the level of ordinary skill in the art can be determined based on information about the field including: the types of problems encountered, known solutions, the speed of innovation, sophistication, and the educational level of active workers. I have considered these types of information along with my own background working with students and other professionals in the field to reach my conclusion.

30. It is my opinion that a person of ordinary skill in the field of the ’876 patent, as of its earliest possible priority date, would have had a bachelor’s degree

in computer science, electrical engineering, or a closely related technical field and three years of experience in wireless communications. Additional education, such as a master's degree in electrical engineering or telecommunications, could substitute for professional experience and significant work experience could substitute for formal education.

31. Based on my experience, I have the capabilities and understandings of a person of ordinary skill in the art. I have worked in the electronics and communications field since the mid-1970s. Since 1984, I have been an employee of Gray and Gray, LLC, and have had a variety of experiences related to telecommunications including: being the CTO for multiple internet-based companies, designing computer networks for clients, designing and implementing telecommunications control devices for Computer Communication Incorporated, and developing and presenting numerous public and in-house courses in IBM, Unix, Internet and related operating system and networking technologies. In this declaration, and for all my opinions herein, I have applied the knowledge of a person of ordinary skill in the art as of November 2, 2001.

B. Claim Construction

32. I have been informed that in an *inter partes* review proceeding, claim terms should be construed under the same standard applied in federal district court

cases. Under this standard, I have been informed that claim terms are generally given their ordinary and customary meaning as understood by one of ordinary skill in the art in light of the specification and the prosecution history pertaining to the patent. I understand, however, that claim terms are generally not limited by the embodiments described in the specification.

33. I understand that in addition to the claims, specification, and prosecution history, other evidence may be considered to ascertain the meaning of claim terms, including textbooks, encyclopedias, articles, and dictionaries. I have been informed that this additional evidence is often less significant and less reliable than the claims, specification, and prosecution history.

34. I have also been informed that claims should only be construed to the extent necessary to resolve any controversy.

35. Based on my review of these materials and my personal knowledge and experience, I have considered the plain and ordinary meaning of each term of the ’876 Patent as it would have been understood by one skilled in the art at the time of the ’876 Patent invention. I apply the plain and ordinary meaning of each claim term throughout this declaration.

V. THE ’876 PATENT

A. Summary of the ’876 Patent

36. The ’876 patent introduces a “method for transmitting channel quality information in a wireless communication system.” Ex. 1001, Claim 1. The system includes a generic “base station” and “mobile station.” *Id*. The base station and mobile station may communicate channel quality information with each other.

37. Claim 1 discloses reporting channel quality information from a mobile station to a base station at two rates: (1) “the mobile station reports channel information at a first rate in the absence of a reception of a data transmission from the base station,” and (2) “at a second rate” “upon detection of a reception of a data transmission from the base station.” Ex. 1001, Claim 1.

38. In my opinion, the ‘876 patent admits in a “known arrangement,” “the purpose of sending channel quality feedback information from the mobile station to the base station is to inform the base station of the transmission rate that best matches the current conditions (e.g., quality) of the channel at that present time.” Ex. 1001, 1:33-44. The difference between the independent claims and the admitted prior art is that channel quality information is transmitted at a **different rate** when the mobile station and base station are communicating data versus when they are not.

B. Summary of Prosecution History of the ’876 Patent

39. I understand that during prosecution, Applicant admitted transmitting channel quality information was known. Ex. 1002, 45. Applicant also admitted “varying rate [of] information exchange between mobile station and base station” based on “when voice or data [is] communicating between these two components” was known. *Id.*, 44.

40. I understand that to convince the Examiner to issue a notice of allowance, Applicant recognized that the aspect of the claims deviating from the cited art is “that ‘channel quality information’ is being **transmitted at different rates** during idle periods when compared with data transmission periods.” Ex. 1002, 45 (emphasis added).

VI. GROUNDS OF UNPATENTABILITY

41. Based on my review of the materials set forth above, including my application of the knowledge of a person of ordinary skill in the art, it is my opinion that claims 1-13 of the ’876 Patent are rendered obvious to one of ordinary skill in the art.

42. In particular, it is my opinion that claims 1-13 of the ’876 Patent would have been rendered obvious to one of ordinary skill in the art, based on the grounds shown below:

Ground	Claims	Reference(s)	Basis
1	1-4, 9, 10	Kiang in view of Zhang	§ 103
2	5, 6, 8	Kiang in view of Zhang and Jacobsmeyer	§ 103
3	7	Kiang in view of Zhang, Jacobsmeyer, and Hortensius	§ 103
4	1, 4, 9, 10	Tong	§ 103
5	2, 3	Tong in view of Zhang	§ 103
6	5, 6, 8	Tong in view of Jacobsmeyer	§ 103
7	7	Tong in view of Jacobsmeyer and Hortensius	§ 103
8	11-13	Tong in view of Chung	§ 103

43.

VII. GROUND 1: KIANG IN VIEW OF ZHANG RENDERS OBVIOUS 1-4, 9, AND 10

A. Overview of Kiang

44. In my opinion, Kiang at least suggests most elements of the independent claims of the ’876 patent, including the purported point of novelty—

transmitting channel quality information at different rates based on whether a base station and mobile station are communicating data.

45. Kiang's MS transmits channel quality information to the BTS, "such as the measured received signal strength during the period the communication link remains active." Kiang, 5:9-15. Kiang discloses two ways the MS reports system data (channel quality information) to the Base Transceiver Station (BTS) when communication is established.

46. Kiang's system discloses the MS can transmit channel quality information to the BTS, "such as the measured received signal strength during the period the communication link remains active." *Id.*, 5:9-15. Kiang discloses two ways the MS reports system data (channel quality information) to the BTS when communication is established.

47. First, Kiang's "autonomous reporting [of system data] from MS 106 to BSC 102 may be performed on a periodic basis" where "[t]he **period of reporting may be a function of the rate of arrival of the transmission data**." *Id.*, 5:33-36 (emphasis added).

48. Second, Kiang explains "the received signal strength may be measured and autonomously reported [by the MS to the BTS] synchronously with the received burst transmission [from the BTS]." *Id.*, 5:36-39. During synchronous

reporting, Kiang*'s* MS sends channel feedback information any time a data transmission is received at the MS from the BTS. *Id*., 5:36-39, 6:51-53.

B. Summary of the Combination

1. Summary of the Kiang-Zhang Combination

49. Kiang discloses a method for periodically or synchronously transmitting system information, such as signal strength, from a mobile station to a base station. Kiang, 4:9-14; 6:51-53. Kiang's base station then uses the measured signal strength to assign transmission parameters such as data rate, bandwidth, and initial output power. *Id.*, 4:63-5:3. In my opinion, to the extent Kiang does not expressly disclose varying the rate of transmission of system information, Zhang expressly discloses using lower rates of reporting control information depending on whether a mobile station is actively receiving data from a base station.

50. Like Kiang, Zhang discloses a method of communicating control information in a wireless communication system between a base station and a mobile station and vice versa. Zhang Provisional, 4:17-28; 9:7-13; Zhang, [0032], [0050]. Although Zhang's examples relate to base station to mobile station transmissions, Zhang's method could be used for the opposite. *See* Zhang Provisional, 2:30-3:2 (discussing that mobile stations may be assigned both a

forward dedicated control channel and a reverse dedicated control channel); Zhang, [0032].

51. To reduce unnecessary power consumption for transmitting control information, Zhang assigns its mobile stations to either an active state (also called the primary active state) or a control hold state (also called the secondary active state). Zhang Provisional, 3:1-10, 5:4-20; Zhang, [0031]. Devices in Zhang's control hold state transmit control information at a reduced rate—either 1/4 or 1/8 of the rate for primary active state devices. Zhang Provisional, 7:8-15; Zhang, [0034].

52. In my opinion, a skilled artisan would have been motivated to implement Zhang's active and control hold states (with the reduced transmission rates in the control hold state), as the method for periodically transmitting Kiang's system information from mobile station to base station to reduce power consumption—a goal recognized by both Zhang and the '876 patent. Zhang Provisional, 3:16-27; Zhang, [0038]; Ex. 1001, 2:44-55.

2. Kiang and Zhang are Analogous Art and Combinable

53. The '876 Patent discloses a channel quality feedback method for wireless transmission including varying the rate for reporting channel quality information from a mobile station to a base station based on the presence or

absence of a transmission from the base station to the mobile station. Ex. 1001, Abstract. The ’876 Patent explains that this method allows for more efficient use of wireless resources. *Id.*, 3:4-19.

54. In the same field of endeavor as the ’876 Patent, Kiang discloses a wireless network with mobile stations reporting system information (like signal strength) to base stations on a periodic basis or based on the arrival of the transmission data from the base station. Kiang, 4:65-5:3.

55. Zhang is in the same field of wireless communication and addresses the same problem of improving efficient data transmission in wireless networks as the ’876 Patent. Zhang Provisional, 3:16-22; Zhang, [0038]. Like the ’876 Patent, Zhang’s wireless communications system comprises a mobile station in communication with a base station. Zhang Provisional, 4:17-28; 9:7-13; Zhang, [0032], [0050]. And like the ’876 Patent, Zhang discloses varying the rate for reporting channel quality information based the presence or absence of a reception data being transmitted on the wireless communication network to allow for more efficient use of wireless resources. Zhang Provisional, 4:3-7; Zhang, [0038].

56. In my opinion, Kiang and Zhang are both analogous to the ’876 Patent and are combinable. Both are in the same field as the patent—communicating information in wireless networks more efficiently. Both address the same problem

as the patent—efficiently using resources for wireless communication over a network.

3. A Skilled Artisan Would Have Been Motivated to Implement Zhang's Variable Transmission Rates in Kiang to Improve Efficiency and Reduce Power Consumption

57. In my opinion, a skilled artisan would have found it obvious to implement Zhang's variable rate as the method for implementing Kiang's periodic transmission of system data from its mobile station to its base station to (1) reduce power consumption and (2) allow existing system resources to be utilized by more mobile stations.

58. **First,** Kiang discloses reporting channel quality information (system data like signal strength) periodically from mobile stations to base stations. Kiang, 5:32-39. But Kiang does not expressly disclose further modifying the reporting period based on system conditions, which would further promote power efficiency. Kiang expressly teaches and suggests such improvement because it discloses monitoring and measuring power consumption history but does not provide an effective way for reducing power consumption. Kiang, 6:60-7:4. In my opinion, a skilled artisan reviewing Kiang would have been motivated to look to other references about improving the power efficiency in wireless communication

networks that periodically report channel quality information and to have a complete understanding of the line quality —like Zhang.

59. Zhang recognizes that saving battery power is important and transmitting channel quality data at less than the full rate reduces power consumption. Zhang Provisional, 3:8-10; 5:4-20; Zhang [0031]. In my opinion, a skilled artisan would have readily recognized that reporting Kiang's channel quality information at lower varied rates, as taught by Zhang, would have further improved Kiang's power efficiency—a reference ready for such improvement.

60. Moreover, to the extent Zhang's exemplary disclosures relate to downlink transmissions (from base station to mobile station) rather than uplink transmissions (from mobile station to base station) as disclosed in Kiang, in my opinion, Zhang expressly teaches and suggests that its methods would equally apply to transmissions in either direction further motivating the combination. Zhang Provisional, 2:30-3:2; Zhang, [0032].

61. Even in view of Zhang's specific disclosures about downlink transmissions, a POSITA would have recognized the applicability of using Zhang's method for uplink transmissions to downlink as well because its method is agnostic to the direction of the transmission, as recognized by Zhang itself. *Id.* The quality assessment disclosed in Zhang could just as easily have been performed Kiang's

mobile station as by a base station because each device was known at the time to perform quality assessments and implementing a method in either a base station or a mobile station would have required only routine skill.

62. **Second,** because the combination of Zhang's varied rates into Kiang's system reduces power consumption, in my opinion, a skilled artisan would have understood that with fewer resources being used, the same base stations could support additional mobile stations with the conserved resources. Because Zhang explicitly discloses a solution to this problem, which is to vary the transmission rate based on data traffic between a mobile station and a base station, in my opinion, a skilled artisan would have been motivated to implement Zhang's varying rates within Kiang's network infrastructure to realize this further benefit of the combination. Zhang Provisional, 5:4-20; Zhang, [0031].

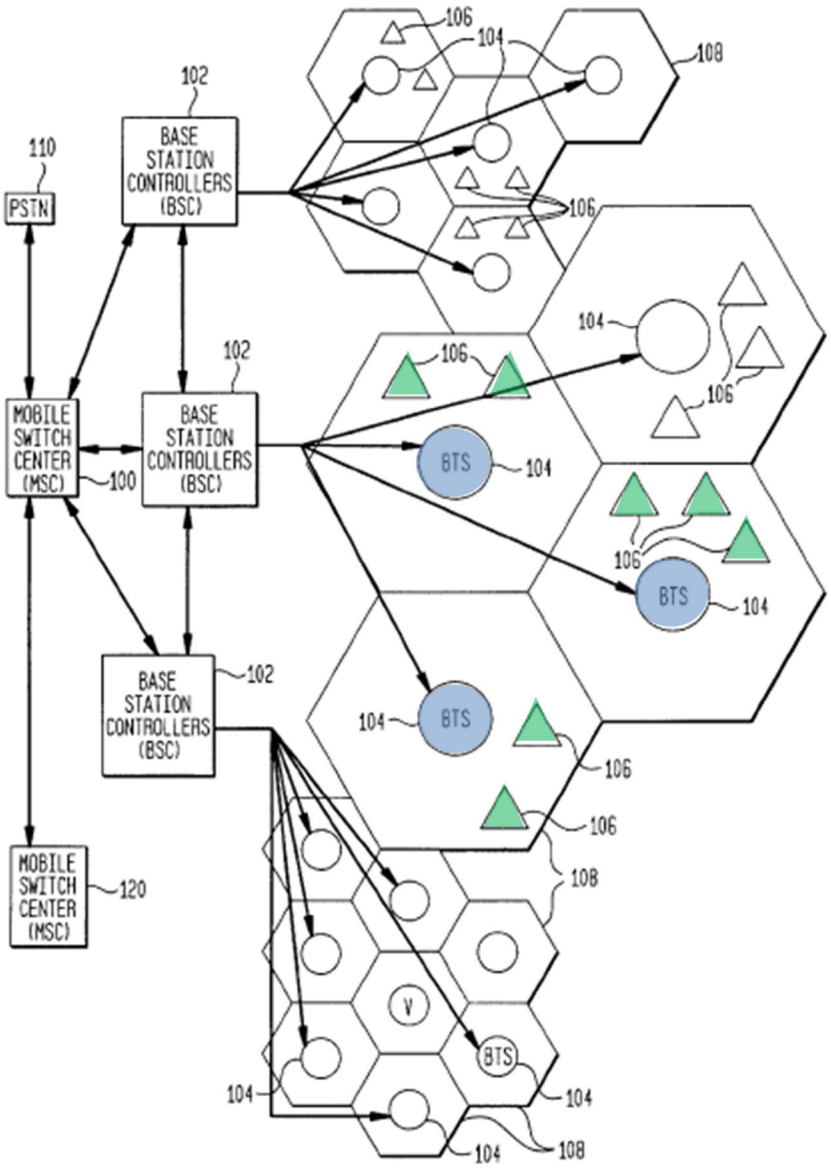
63. In my opinion, a skilled artisan would have had a reasonable expectation of success in implementing Zhang's variable rates as for Kiang's periodic reporting of channel quality information because Kiang already discloses periodic reporting and modifying reporting based on the reception of data from a base station. Because Kiang's system is already configured to adjust rates, using Zhang's method for adjustment would have required only routine skill.

C. Claim 1

1. 1[preamble]: "A method for transmitting channel quality information in a wireless communication system comprising at least one base station and at least one mobile station, the method comprising:"

64. Kiang discloses 1[preamble]. Kiang discloses a "typical wireless communication system" that includes "a plurality of Base Transceiver Stations (BTS) 104 [(base station)] and multiple remote users, each operating a Mobile Station (MS) 106 [(mobile station)]." Kiang, 4:9-14.

FIG. 1



Kiang, FIG. 1 (annotated).

65. Kiang's wireless communication system performs a method for transmitting channel quality information because Kiang's MS "autonomously provide[s], to the BSC 102, through BTS 104, system data, such as the measured

received signal strength during the period the communication link remains active." *Id.*, 5:9-15.

2. 1[a]: "varying a rate for reporting channel quality information from a mobile station as a function of the presence or absence of a reception of a data transmission at the mobile station,"

66. In my opinion, Kiang in combination with Zhang renders obvious 1[a]. Kiang discloses or renders obvious 1[a] because it discloses sending system data (channel quality information) either (1) periodically as a function of the arrival of data transmissions from the BTS or (2) synchronously with the receipt of a burst transmission from the BTS (both the presence or absence of a reception of data at the mobile station).

67. **First,** Kiang discloses that its MS varies its rate for reporting system data (channel quality information) based on the frequency at which it is receiving data from the BCS (via the BTS), stating, "the autonomous reporting from MS 106 to BSC 102 may be performed on a periodic basis" where "[t]he period of reporting may be a function of the rate of arrival of the transmission data." Kiang, 5:33-36.

68. It is my opinion that a person of ordinary skill in the art would have understood that adjusting the period of reporting as a function of the rate of arrival of the transmission data from the BCS (via the BTS) comprises varying a rate for

reporting channel quality information from a mobile station as a function of the presence or absence of a reception of data. Kiang's period of reporting system data would have been understood to indicate a rate of reporting channel quality information because the period of reporting indicates how frequency or rate (e.g., number of transmissions in a given time) the MS sends. Adjusting the period of reporting based on a function of the rate of arrival of the transmission data would have been understood as varying the rate based on the presence or absence of reception of data at the MS from the BTS because when data is being received frequently in a given period (the presence of a reception of data), Kiang's rate of reporting channel quality information increases. Conversely, when data is being received infrequently in a given period (the absence of a reception of data), Kiang's rate of reporting channel quality information decreases.

69. **Second,** Kiang further explains that "the received signal strength may be measured and autonomously reported [by the MS to the BTS] synchronously with the received burst transmission [from the BTS]." Kiang, 5:36-39. That is, Kiang's MS sends channel feedback information any time a data transmission is received at the MS from the BTS. *Id.*

70. Transmitting channel feedback information synchronously when data is received from the BTS would have been understood as varying the rate based on

the presence or absence of reception of data. Like the periodic reporting, when data is being received frequently in a given period (the presence of a reception of data), Kiang's rate of reporting channel quality information increases by being sent synchronously with each frequently received data reception. Conversely, when data is being received infrequently in a given period (the absence of a reception of data), Kiang's rate of reporting channel quality information decreases by being sent synchronously with each infrequently received data reception.

71. In my opinion, to the extent Kiang does not expressly disclose this limitation because its periodic or synchronous transmissions are not varying "as a function of the presence or absence of a reception of a data transmission," Zhang expressly discloses varying the rate of transmissions as a function of the presence or absence of a reception of a data transmission, and it would have been obvious to modify Kiang's periodic rate for reporting channel quality information from a mobile station to vary the periodic rate as a function of the presence or absence of a reception of a data transmission.

72. Zhang discloses transmitting control information between a network apparatus (base station) and mobile stations at different rates, depending on whether the particular mobile station is classified as being in the active state (a primary active user state) or a control hold state (a secondary active user state).

Zhang, [0031]; Zhang Provisional, 3:1-10, 3:24-27, 5:4-20; Zhang, [0031], [0038]. That is, "active users are divided into a plurality of sets of users, each set of users having a different transmission rate assigned for common control channels." Zhang Provisional, 3:24-27; Zhang, [0038].

73. For example, users in the first set (those classified as in the primary active user state) would transmit and receive control information "at a first rate of transmission" and those in the second set (those classified as in the secondary active user state) would transmit and receive control information "at a second rate of transmission via the common control channel, the second rate of transmission being less than the first rate of transmission." Zhang Provisional, 4:20-28, 4:29-5:3; Zhang, [0026], [0028].

74. Whether a mobile station is in the active state or the control hold state is dependent on whether the device is actively receiving data transmissions, indicated by whether the data buffer for transmissions to the mobile station is empty or not over a period of time. Zhang Provisional, 5:4-31; Zhang, [0016], [0031]. Zhang's mobile station enters a control hold state when "the data buffer within an active user becomes empty for some period of time," (i.e., no transmissions are being received from the base station) and then the device will

only send control transmissions (reporting channel quality information) at a reduced rate. Zhang Provisional, 3:1-10, 5:4-20; Zhang, [0031].

75. Conversely, Zhang's active state corresponds to situations when there is being communicated because indicated by data in the active user buffer. Zhang Provisional, 3:1-10, 5:4-20; Zhang, [0031]. Thus, Zhang discloses varying the rate of transmission based on the whether a user is in the active state (data in the transmission buffer, presence of the reception of a data transmission) or the control hold state (no data in the transmission buffer, absence of the reception of a data transmission).

76. In my opinion, a skilled artisan would have been motivated to modify Kiang's periodic transmission of channel quality information to vary the periodic transmission rate based on the presence or absence of data transmissions, as taught by Zhang, for the reasons explained in Section VII.B.

3. 1[b]: "wherein the mobile station reports channel quality information at a first rate in the absence of a reception of a data transmission from the base station and,"

77. In my opinion, Kiang in combination with Zhang renders obvious 1[b]. Kiang discloses sending system data (channel quality information) either (1) periodically as a function of the arrival of data transmissions from the BTS or (2)

synchronously with the receipt of a burst transmission from the BTS (both the presence or absence of a reception of data at the mobile station).

78. But Kiang does not expressly disclose "a first rate in the absence of a reception of a data transmission." Zhang, however, expressly discloses using a first rate (Zhang's second rate for devices in the control hold state) in the absence of reception of data, and it would have been obvious to modify Kiang's mobile station's periodic rate for reporting channel quality information from the mobile station to be a first rate in the absence of the reception of data.

79. Zhang's stations (which could be mobile stations, or which would have been obvious to implement on a mobile station) classified as in the secondary active user state or control hold state would transmit and receive control information "at a second rate of transmission via the common control channel, the second rate of transmission being less than the first rate of transmission." Zhang Provisional, 4:20-28, 4:29-5:3; Zhang, [0026], [0032]. Zhang's station enters a control hold state when "the data buffer within an active user becomes empty for some period of time," (i.e., no transmissions are being received) and then the device will only send control transmissions (reporting channel quality information) at a reduced rate. Zhang Provisional, 3:1-10, 5:4-20; Zhang, [0031]. Thus, Zhang discloses transmitting at a first rate in the absence of a reception of a data

transmission when in the control hold state (no data in the transmission buffer, absence of the reception of a data transmission). As implemented in Kiang's mobile station, a person of ordinary skill in the art would have understood that the buffer monitored would be a buffer at Kiang's mobile station.

80. In my opinion, a skilled artisan would have been motivated to modify Kiang's mobile station's periodic transmission of channel quality information to use a first reduced rate based in the absence of data transmissions, as taught by Zhang, for the reasons explained in Section VII.B.

4. 1[c]: "upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality at a second rate for a prescribed duration."

81. In my opinion, Kiang in combination with Zhang renders obvious 1[c]. Kiang discloses sending system data (channel quality information) either (1) periodically as a function of the arrival of data transmissions from the BTS or (2) synchronously with the receipt of a burst transmission from the BTS (both the presence or absence of a reception of data at the mobile station).

82. But Kiang does not expressly disclose "a second rate" "upon detection of a reception of a data transmission." Zhang, however, expressly discloses using a second rate (Zhang's first rate for devices in the active state) in the presence of reception of data, and, in my opinion, it would have been obvious to modify

Kiang's mobile station's periodic rate for reporting channel quality information from the mobile station to be a second rate in the presence of the reception of data.

83. Zhang's mobile stations classified as in the primary active user state or active state transmit and receive control information "at a first rate of transmission" that is faster than those mobile stations in the control hold state. Zhang Provisional, 4:20-28, 4:29-5:3; Zhang, [0026], [0032]. Zhang's active state corresponds to situations when there is data being communicated as indicated by data in the active user buffer. Zhang Provisional, 3:1-10, 5:4-20; Zhang, [0031]. Thus, in my opinion, Zhang discloses transmitting at a second rate in the presence of a reception of a data transmission when in the control active state (data in the transmission buffer, presence of the reception of a data transmission).

84. Zhang also discloses that the active state and second rate are applied for a prescribed duration for two reasons. **First,** Zhang discloses requiring a buffer to be empty for a period of time before switching from the active state to the control hold state, stating, "a switch condition is detected [upon] determining whether the data buffer is in an empty condition for a predetermined period of time." Zhang Provisional, 5:10-20, 3:2-8; Zhang, [0031].

85. **Second**, Zhang discloses setting a timer for the active state and switching the control state at the expiration of the timer, stating, "the procedure for

switching a mobile station from a primary active user to a secondary active user includes setting a timer with a very small value after the primary active user's buffer at the network-level becomes empty. At the expiration of the timer, the network sends a layer 2 control message to explicitly request the mobile station of the primary active user to switch to the rate-reduced mode of a secondary active user." Zhang Provisional, 9:22-31; Zhang, [0051]. As implemented in Kiang's mobile station, a person of ordinary skill in the art, in my opinion, would have understood that the buffer monitored would be a buffer at Kiang's mobile station.

86. In my opinion, a skilled artisan would have been motivated to modify Kiang's mobile station's periodic transmission of channel quality information to use a second faster rate for a prescribed period of time based on the presence of data transmissions, as taught by Zhang, for the reasons explained in Section VII.B.

D. Claim 9

1. 9[preamble]: "A method for adapting the rate of reporting channel quality information in a wireless communication system including at least one base station and at least one mobile station, the method comprising:"

87. 9[preamble] is substantially similar to 1[preamble] and 1[b] except that it uses the term "adapting" instead of "varying," which does not change the meaning of the claim. In my opinion, Kiang in combination with Zhang renders

obvious renders obvious 9[preamble] for the reasons explained for 1[preamble] (Section VII.C.1) and 1[a] (Section VII.C.2).

2. 9[a]: "reporting channel quality information from the at least one mobile station to the at least one base station at a first rate in the absence of a reception of a data transmission at the at least one mobile station; and"

88. 9[a] is substantially similar to claim 1[b]. In my opinion, Kiang in combination with Zhang renders obvious 9[a] for the reasons explained for 1[b] (Section VII.C.3).

3. 9[b]: "in the presence of a reception of a data transmission at the at least one mobile station, adapting the rate for reporting channel quality information from the at least one mobile station to the at least one base station from the first rate to a second rate for a prescribed duration."

89. 9[b] is substantially similar to 1[c]. In my opinion, Kiang in combination with Zhang renders obvious 9[b] for the reasons explained for 1[c] (Section VII.C.4).

E. Claim 2: "The method according to claim 1, wherein, upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality information at a plurality of rates over a prescribed time period after detection of the reception of a data transmission,

wherein the plurality of rates are different from the first rate."

90. In my opinion, Kiang in combination with Zhang renders obvious 2[a]. Zhang discloses using a plurality of rates for transmitting channel quality

information. Zhang discloses that certain users may have a 1/4 rate or a 1/8 rate, which "can be dynamically changed based on real time traffic load of the active users." Zhang Provisional, 8:29-9:31; Zhang, [0050]-[0051]. Zhang explains that switching a user from a transmitting at the full rate to transmitting at either 1/4 or 1/8 rate can be conducted based on a prescribed time period by "setting a timer with a very small value after the primary active user's buffer at the network-level becomes empty" and "[a]t the expiration of the timer" "switch[ing] to the rate-reduced mode if a secondary active user." Zhang Provisional, 9:22-31, 10:20-11:7; Zhang, [0051]-[0054].

91. In my opinion, a skilled artisan would have understood that for any prescribed time period greater than the "timer with a very small value" after reception of data, at least two rates would be used—the full rate for the duration until the buffers have been empty upon the expiration of the timer and the reduced 1/4 or 1/8 rate thereafter.

92. In my opinion, a skilled artisan would have further understood that the plurality of rates in Zhang (the 1/4 and 1/8 rates) could be used as a step-down procedure. That is, the longer the buffer remains empty, the transmission rate continues to decrease like from 1/4 to 1/8. Zhang explains that there may be a "third set of mobile stations at a third rate of transmission … the third rate of

transmission being less than the second rate of transmission." *Id.*, claim 3, 8, 16. In my opinion, a skilled artisan would have understood that in a system with three sets of mobile stations, a mobile station may transition from the first set to the second set to the third set during a prescribed time period, depending on the time the buffers have been empty, thus communicating at a plurality of rates during the time period, two of which are slower than the first rate.

93. Further, in my opinion, a skilled artisan would have been motivated modify Kiang's periodic transmission of channel quality information to transmit at a plurality of rates after reception of data, as taught by Zhang, for the reasons explained in Section VII.B.

F. Claim 3: "The method according to claim 2, wherein the prescribed time period includes a plurality of time intervals such that the channel quality information is reported at different ones of the plurality of rates during different ones of the plurality of time intervals."

94. In my opinion, Kiang in combination with Zhang renders obvious claim 3. As explained for claim 2 (Section VII.E), Zhang discloses transmitting at a plurality of rates over a prescribed time period. Because Zhang discloses that the rate is reduced after expiration of a "timer with a very small value," in my opinion, a skilled artisan would have understood each timer to comprise the claimed plurality of time intervals, each reflecting a different rate. That is, in a configuration with three sets of mobile stations (set 1 operating at full rate, set 2

operating at 1/4 rate, and set 3 operating at 1/8 rate), transitioning from set 1 to set 2 would occur after expiration of a first timer (a first time interval) and transitioning from set 2 to set 3 would occur after expiration of the second timer (a second time interval).

95. Zhang discloses transmitting at a plurality of rates during a plurality of time intervals during a prescribed period (any time period greater than the duration of the combined timers).

96. In my opinion, a skilled artisan would have been motivated modify Kiang's periodic transmission of channel quality information to transmit at a plurality of rates after reception of data, as taught by Zhang, for the reasons explained in Section VII.B.

G. Claims 4 and 10: "The method according to claim [1/10], wherein the second rate is faster than the first rate."

97. In my opinion, Kiang in combination with Zhang renders obvious claims 4 and 10. As explained for 1[a]-1[c] (Sections VII.C.2-VII.C.4), Kiang in combination with Zhang teaches varying or adapting the rate of reporting channel quality information from a first rate (slower, in the absence of reception of data) to a second rate (faster, when detecting reception of data).

VIII. GROUND 2: KIANG IN VIEW OF ZHANG AND JACOBSMEYER RENDERS OBVIOUS CLAIMS 5, 6, AND 8

A. Claim 5: "The method according to claim 1, further comprising the step of estimating channel quality at the base station while the mobile station is reporting at the second rate, wherein estimated channel quality is used to derive a transmission format for a subsequent transmission."

98. In my opinion, Kiang in view of Zhang and Jacobsmeyer renders obvious claim 5.

99. Kiang in view of Zhang renders obvious claim 1. Jacobsmeyer discloses the step of estimating channel quality to derive a transmission format (the data rate for future transmissions).

100. Jacobsmeyer, like the '876 patent, Kiang, and Zhang, discloses a wireless communication system, including mobile stations and base stations, directed to "achieving greater throughput." Jacobsmeyer, 3:1-5. Jacobsmeyer is therefore, in my opinion, analogous.

101. Jacobsmeyer discloses an "[e]stimator 70 connected to a return channel transmitter 78." Jacobsmeyer, 9:47. Estimator 70 "estimates the signal quality and selects a new data rate based on channel conditions" that is then "transmitted on return channel 80 for use by encoder 58 to determine the next data rate." Jacobsmeyer, 11:51-54.

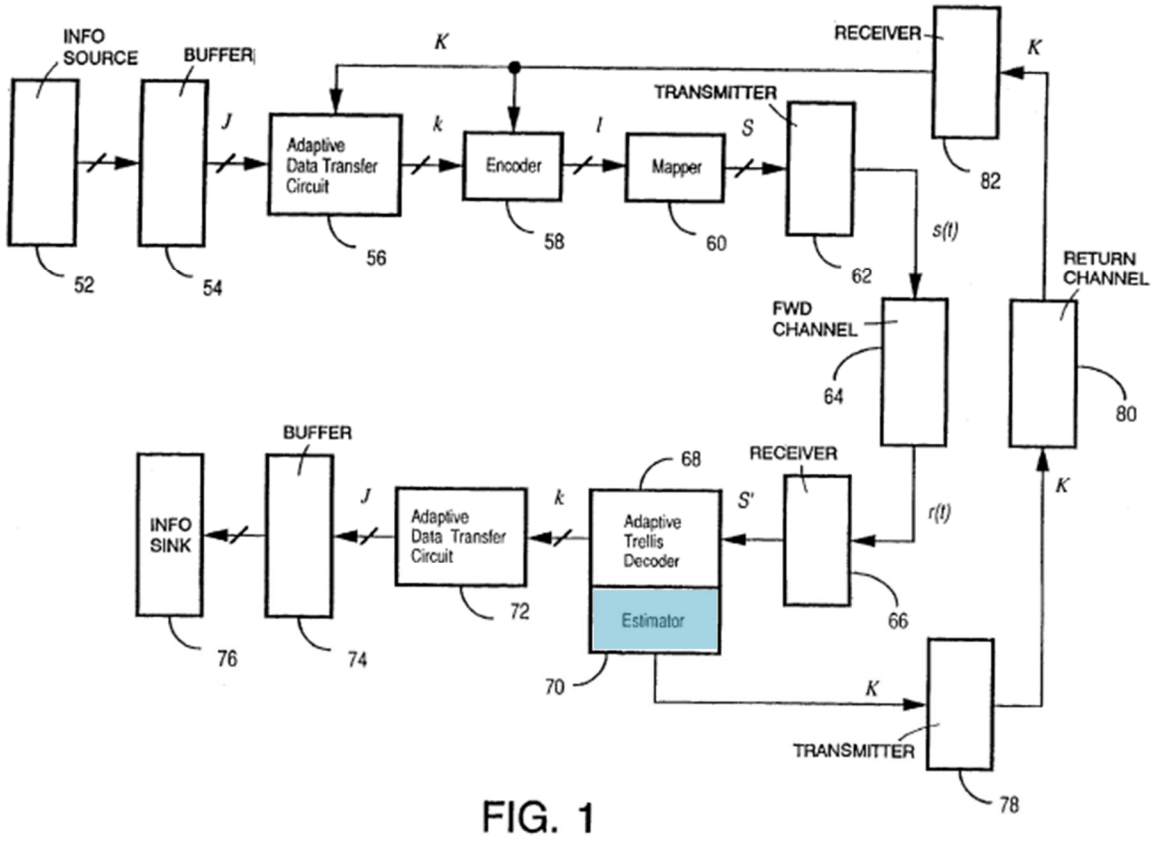


FIG. 1

Jacobsmeyer, FIG. 1 (annotated).

102. Jacobsmeyer's data rate is the claimed transmission format because it defines the rate at which future transmissions will take place—the format of the transmission. Jacobsmeyer, 6:15-18 ("data rate, or throughput, of a communications channel"); Ex. 1001, Claim 6 (defining transmission format as including "transmission rate").

103. In combination, in my opinion, a skilled artisan would have been motivated to implement an estimator in Kiang's base station to derive a new data rate (transmission format), as taught by Jacobsmeyer to "achieve greater

throughput on [a] fading communication channel." Jacobsmeyer, 3:1-5. While channel strength estimators were well-known features of wireless communication systems, both on the base stations side and the mobile station side of the channel, neither Kiang nor Zhang disclose using an estimator.

104. Additionally, in my opinion, the benefits of using an estimator would have been obvious, as expressly described by Jacobsmeyer—"estimate[ing] the signal quality and select[ing] a new data rate based on channel conditions" to optimize the channel communications and "achieve greater throughput". Jacobsmeyer, 11:51-52, 3:5-1.

105. Accordingly, in my opinion, it would have been obvious to a skilled artisan to implement Jacobsmeyer's well-known estimator in Kiang's base station to increase the throughput on the channel by selecting an optimized data rate for future transmissions and would have reasonably expected success in doing so because the estimator is being used for its conventional purpose.

B. Claim 6: "The method according to claim 5, wherein the transmission format includes one or more parameters selected from the group consisting of modulation format, number of codes, and transmission rate."

106. In my opinion, Kiang in view of Zhang and Jacobsmeyer renders obvious claim 5.

107. Jacobsmeyer discloses a transmission format, including a transmission or data rate: "Estimator 70 "estimates the signal quality and selects a new data rate based on channel conditions" that is then "transmitted on return channel 80 for use by encoder 58 to determine the next data rate." Jacobsmeyer, 11:51-54. Jacobsmeyer's data rate is the claimed transmission rate because Jacobsmeyer's data rate is the rate of transmission for future transmissions over the channel. Jacobsmeyer, 6:15-18 ("data rate, or throughput, of a communications channel").

108. In combination, in addition to the channel strength transmitted by Kiang, in my opinion, a skilled artisan would have been motivated to implement an estimator to transmit a new data rate, as taught by Jacobsmeyer, which defines a transition format, for the reasons explained in Section VIII.A.

C. Claim 8: "The method according to claim 1, wherein the channel quality information comprises a transmission rate calculated by the mobile station based on one or more channel conditions."

109. In my opinion, Kiang in view of Zhang and Jacobsmeyer renders obvious claim 8.

110. Kiang in view of Zhang render obvious claim 1. Jacobsmeyer discloses transmitting a data rate (transmission rate) calculated by the mobile station based on channel conditions.

111. Jacobsmeyer discloses an "[e]stimator 70 connected to a return channel transmitter 78." Jacobsmeyer, 9:47. Estimator 70 "estimates the signal quality and selects a new data rate based on channel conditions" that is then "transmitted on return channel 80 for use by encoder 58 to determine the next data rate." Jacobsmeyer, 11:51-54.

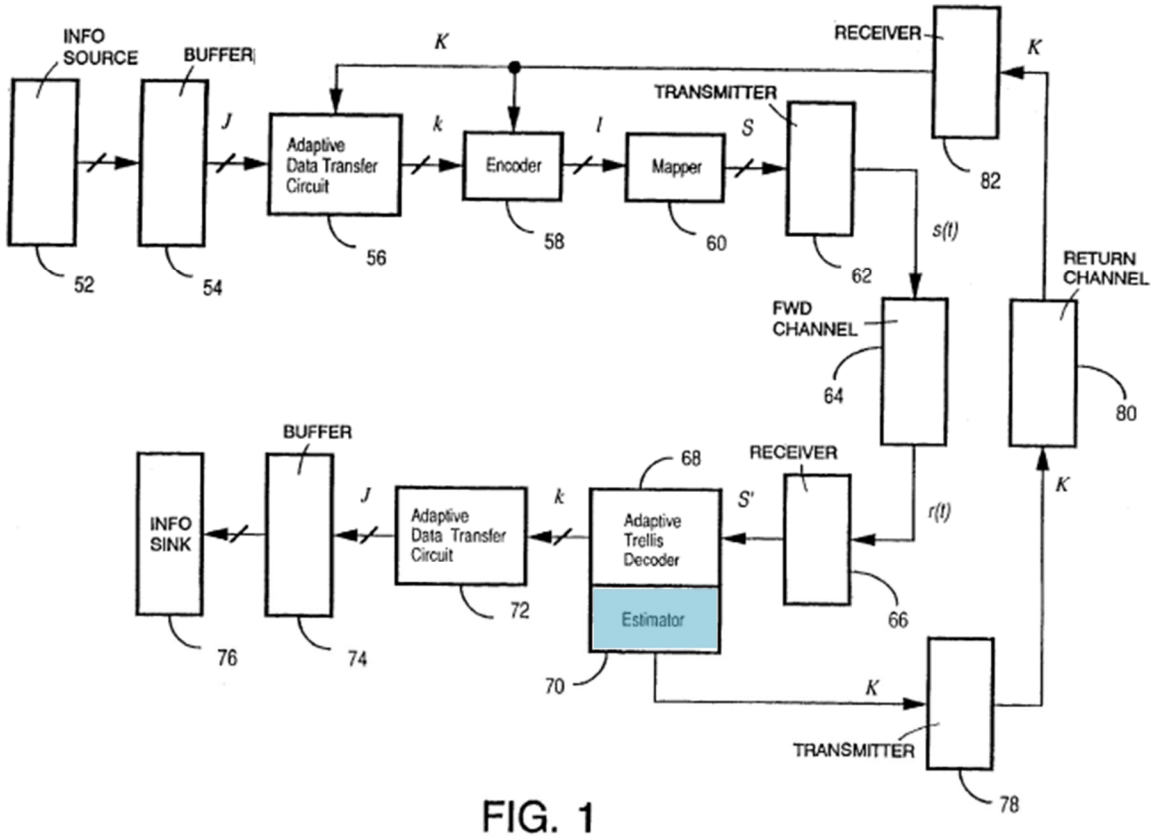


FIG. 1

Jacobsmeyer, FIG. 1 (annotated).

112. In my opinion, Jacobsmeyer's data rate is the claimed transmission rate because Jacobsmeyer's data rate is the rate of transmission for future

transmissions over the channel. Jacobsmeyer, 6:15-18 ("data rate, or throughput, of a communications channel").

113. In combination, in addition to the channel strength transmitted by Kiang, a skilled artisan, in my opinion, would have been motivated to implement an estimator in Kiang to derive a new data rate (transmission rate) to be transmitted along with the channel strength, as taught by Jacobsmeyer for the reasons explained in Section VIII.A

IX. GROUND 3: KIANG IN VIEW OF ZHANG, JACOBSMEYER AND HORTENSIUS RENDERS OBVIOUS CLAIM 7

A. Claim 7

1. 7[a]: "The method according to claim 1, further comprising the step of estimating channel quality at the base station while the mobile station is reporting at the second rate,"

114. In my opinion, 7[a] is identical to claim 5 and rendered obvious by Kiang in view of Zhang, Jacobsmeyer, and Hortensius for the same reasons (Section VIII.A).

2. 7[b]: "wherein estimated channel quality is used to calculate an amount of redundancy needed for a retransmission of a previous data transmission."

115. In my opinion, Kiang in view of Zhang, Jacobsmeyer, and Hortensius renders obvious 7[b].

116. Hortensius, like the ’876 patent, Kiang, Zhang, and Jacobsmeyer, discloses a wireless communication system, including mobile stations and base stations. Hortensius, Abstract. In my opinion, Hortensius is thus analogous.

117. Hortensius discloses calculating a “repetition rate RR*” using a “rate management module” that evaluates the “RR* and make[s] a decision regarding which RR value with which to encode the data” using “one or more tables.” Hortensius, 3:41-50.

118. In combination, a skilled artisan, in my opinion, would have been motivated to implement an estimator in Kiang’s base station to derive a new data rate (transmission format), as taught by Jacobsmeyer for the reasons explained in Section VIII.A. A skilled artisan would further have been motivated to implement the new data rate of Jacobsmeyer to calculate a repetition rate (amount of redundancy) “before the next data packet is sent” to ensure the appropriate retransmission of previous transmissions. Hortensius, 3:11-20

119. Hortensius acknowledges that a “key concern[] in wireless communication systems is the sudden loss of a connection between two communicating stations … when [they] move out of reach of each other; i.e., one station’s signal gets too weak for the other station to detect.” *Id.*, 1:28-33. This concern would be realized in Kiang, Zhang, and Jacobsmeyer as well, as each

teaches mobile stations that may move out of reach of each other. Jacobsmeyer's estimator is further directed to measuring signal strength on fading channels (like those identified as a concern in Hortensius), but none of the references provides a solution to preventing packet loss over these fading channels.

120. In my opinion, Hortensius's repetition rate would address this problem, thus motivating a skilled artisan to implement Hortensius's repetition rate in the combination, and a skilled artisan would have reasonably expected success in implementing a repetition rate in the combination because repetition rates were well-known in the art, as extensively explained in Hortensius. Hortensius, 1:28-57 (citing Jacobsmeyer along with several other references).

X. Ground 4: Tong Renders Obvious Claims 1, 4, 9, and 10

A. Tong

121. In my opinion, Tong discloses all elements of the independent claims of the '876 patent, including the purported point of novelty—transmitting channel quality information at different rates based on whether a base transceiver station (BTS) and mobile station (MS) are communicating data.

122. Tong's MS transmits channel quality information to the BTS through a "pilot signal." Tong, [0046]. Tong states that normally, "the pilot signal is transmitted every other time interval such that it corresponds to the time intervals

that are allocated to the user group." *Id*. However, to "allow user terminals to determine channel quality conditions for the user group in which data is not being transmitted, the pilot signal must be periodically transmitted even when data is not present." *Id*.

B. Claim 1

1. 1[preamble]: "A method for transmitting channel quality information in a wireless communication system comprising at least one base station and at least one mobile station, the method comprising:"

123. In my opinion, Tong discloses 1[preamble] because Tong discloses a wireless communication system in which user terminals (mobile stations) within a sector transmit pilot signals comprising signal-to-noise ratio or carrier-to interference ratio data (channel quality information) to the base transceiver station (BTS) (base station) on a reverse link. Tong, [0040], [0041].

2. 1[a]: "varying a rate for reporting channel quality information from a mobile station as a function of the presence or absence of a reception of a data transmission at the mobile station,"

124. In my opinion, Tong discloses or renders obvious 1[a] because it discloses that the mobile stations transmit a pilot signal (channel quality information) periodically, but the period is suppressed when no data is transmitted during an allocated time interval (as a function of the presence or absence of a reception of a data transmission).

125. Tong states that normally, "the pilot signal is transmitted every other time interval such that it corresponds to the time intervals that are allocated to the user group." Tong, [0046]. However, the pilot signal is "further suppressed when no data is transmitted during an allocated time interval," or in other words, when no data is being transmitted from the BTS to the user group in the time interval. *Id*

126. However, to "allow user terminals to determine channel quality conditions for the user group in which data is not being transmitted, the pilot signal must be periodically transmitted even when data is not present." Tong, [0046]. To ensure the channel quality conditions are still transmitted, in the absence of received data, Tong discloses transmitting channel quality conditions "every four slot cycles even when data is not transmitted for the user group." *Id.*

127. In my opinion, a skilled artisan would have understood that transmitting every four slot cycles in the absence of received data, and every slot cycle in the presence of received data, to comprise transmitting channel quality information as a function of the presence or absence of received transmissions because the rate is suppressed in the absence of received data and not suppressed in the presence of received data.

3. 1[b]: "wherein the mobile station reports channel quality information at a first rate in the absence of a reception of a data transmission from the base station and,"

128. In my opinion, Tong discloses or renders obvious 1[b] because Tong transmits channel quality information from its mobile station the BTS every fourth slot cycle, rather than once per slot cycle, in the absence of reception of data transmissions from the BTS.

129. Tong states that normally, "the pilot signal is transmitted every other time interval such that it corresponds to the time intervals that are allocated to the user group." Tong, [0046]. However, the pilot signal is "further suppressed when no data is transmitted during an allocated time interval," or in other words, when no data is being transmitted from the BTS to the user group in the time interval. *Id.*

130. However, to "allow user terminals to determine channel quality conditions for the user group in which data is not being transmitted, the pilot signal must be periodically transmitted even when data is not present." Tong, [0046]. To ensure the channel quality conditions are still transmitted, in the absence of received data, Tong discloses transmitting channel quality conditions "every four slot cycles even when data is not transmitted for the user group." *Id*

131. In my opinion, a skilled artisan would therefore have understood that because Tong discloses suppressing its rate of reporting channel quality conditions to every fourth slot cycle (a first rate) in the absence of reception of data.

4. 1[c]: "upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality at a second rate for a prescribed duration."

132. In my opinion, Tong discloses or renders obvious 1[c] because Tong transmits channel quality information from its mobile station the BTS once per slot cycle in the presence of reception of data transmissions from the BTS.

133. Tong states that normally, "the pilot signal is transmitted every other time interval such that it corresponds to the time intervals that are allocated to the user group." Tong, [0046]. However, the pilot signal is "further suppressed when no data is transmitted during an allocated time interval," or in other words, when no data is being transmitted from the BTS to the user group in the time interval. *Id*.

134. In my opinion, a skilled artisan would therefore have understood that because Tong discloses suppressing its rate of reporting channel quality conditions to every fourth slot cycle in the absence of reception of data, in the presence of reception of data the full rate of once per slot cycle (a second rate) for reporting channel quality conditions is used in the presence of reception of data.

135. In my opinion, Tong further discloses that this rate is used for a prescribed duration for two reasons. **First,** because Tong discloses slot cycles, a skilled artisan would have understood that the rate of once per slot cycle is used at least for the current slot cycle—a prescribed duration. **Second**, because Tong discloses suppressing the rate of reporting channel quality conditions to every fourth slot cycle in the absence of reception of data, a skilled artisan would have understood that Tong would use the first rate of once per slot cycle until data is not received—also a prescribed duration.

C. Claim 9

1. 9[preamble]: "A method for adapting the rate of reporting channel quality information in a wireless communication system including at least one base station and at least one mobile station, the method comprising:"

136. In my opinion, 9[preamble] is substantially similar to 1[preamble] and 1[b] except that it uses the term "adapting" instead of "varying," which does not change the meaning of the claim. Tong discloses or renders obvious 9[preamble] for the reasons explained for 1[preamble] (Section X.B.1) and 1[a] (Section X.B.2).

2. 9[a]: "reporting channel quality information from the at least one mobile station to the at least one base station at a

first rate in the absence of a reception of a data transmission at the at least one mobile station; and"

137. In my opinion, 9[a] is substantially similar to 1[b]. Tong discloses or renders obvious 9[a] for the reasons explained for 1[b] (Section X.B.3).

3. 9[b]: "in the presence of a reception of a data transmission at the at least one mobile station, adapting the rate for reporting channel quality information from the at least one mobile station to the at least one base station from the first rate to a second rate for a prescribed duration."

138. In my opinion, 9[b] is substantially similar to 1[c]. Tong discloses or renders obvious 9[b] for the reasons explained for 1[c] (Section X.B.4).

D. Claims 4 and 10: "The method according to claim [1/10], wherein the second rate is faster than the first rate."

139. Tong renders obvious claims 4 and 10. As explained for 1[a]-1[c] (Sections X.B.2- X.B.4), Tong teaches varying or adapting its rate of reporting channel quality information from a first rate (slower, in the absence of reception of data from the BTS) to a second rate (faster, when receiving data from the BTS).

XI. GROUND 5: TONG IN VIEW OF ZHANG RENDERS OBVIOUS CLAIMS 2 AND 3

A. Summary of the Combination

1. Summary of the Tong-Zhang Combination

140. As explained in Section X.A, Tong discloses a wireless communication system in which user terminals (mobile stations) within a sector transmit channel quality signals (pilot signals) comprising signal-to-noise ratio or

carrier-to-interference radio data to the base transceiver station on a reverse link. Tong, [0040]-[0041]. In other words, Tong discloses adjusting channel quality reporting rates based on reception of data from a base station but does not expressly disclose using a plurality of rates during a time period.

141. Zhang discloses assigning various groups of secondary active state users, each with a separate reduced reporting rate. In my opinion, a skilled artisan would have been motivated to implement a plurality of reduced reporting rates over a given period, as taught by Zhang, as Tong's method for periodic reporting to enhance power efficiency. As explained in Section VII.B.3, Zhang's exemplary discussion of downlink transmissions is inconsequential in combination because a person of ordinary skill in the art would have understood Zhang's method to apply equally to either a base station or a mobile station.

2. A Skilled Artisan Would Have Been Motivated to Implement Zhang's Plurality of Variable Rates in Tong's Wireless Communication System

142. In my opinion, a skilled artisan would have found it obvious to implement Zhang's variable rates as the method for implementing Tong's periodic signal transmission from a mobile station to a base station to (1) increase transmission efficiency and (2) improve resource allocation in wireless communication networks.

143. Tong discloses periodically transmitting a pilot signal every other time interval such that it corresponds to time intervals that are allocated to a specific user group (mobile stations). Tong, [0046]. Tong also discloses that the pilot signal is suppressed when no data is transmitted during an allotted time interval. *Id.* The user terminals are then able to determine channel quality for each user group based on the transmitted pilot signal, thereby reducing interference between mobile and base stations and increasing transmission efficiency. *Id.*

144. While Tong expressly teaches and suggests methods for increasing transmission efficiency in wireless communications networks by suppressing pilot signal transmission rates, it only provides two possible rates—full and suppressed.

145. In my opinion, a skilled artisan reviewing Tong would have recognized that further efficiency might be gained by using a plurality of rates and would have been motivated to look to other references to further improve network transmission efficiency, to reduce power consumption, and to have a complete understanding of the line quality —like Zhang.

146. Zhang recognizes that saving battery power is an important way to increase network transmission efficiency and that transmitting channel quality data at less than the full rate reduces power consumption. Zhang Provisional, 3:8-10, 15-27; Zhang, [0031], [0038]. Zhang discloses stepping down its channel quality

reporting rates based on the amount of transmission data received at the mobile station. Zhang Provisional, 7:8-15; Zhang, [0034]. For example, depending on the received data, Zhang discloses reporting channel quality data at 1/2, 1/4, or 1/8 the full rate. Zhang Provisional, 7:8-15; Zhang, [0034].

147. In my opinion, a skilled artisan would have readily recognized that Zhang's varied rates would improve the periodic signal transmissions in Tong by further conserving network resource consumption by using a plurality of rates rather than just two and thereby would allow for more mobile stations to access the network—a goal identified in Tong. *See* Tong, [0013] (explaining that there is a need to increase data throughput capacity in a wireless network); *see also* [0062] (noting that a battery powers the RF unit for each mobile station).

148. In my opinion, a skilled artisan would have had a reasonable expectation of success in implementing Zhang's variable rates in Tong's periodic reporting because Tong already discloses either transmitting or not transmitting pilot signal information based on the data received. Zhang merely provides the next logical step in Tong's system. Because Tong's system is already configured to report channel quality information periodically, using Zhang's method for varying rates would have required only routine skill.

B. Claim 2: "The method according to claim 1, wherein, upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality information at a plurality of rates over a prescribed time period after detection of the reception of a data transmission,

wherein the plurality of rates are different from the first rate."

149. In my opinion, Tong in combination with Zhang renders obvious 2[a]. As explained for claim 2 of Ground 1 (Section VII.E), Zhang teaches using a plurality of rates for transmitting channel quality information over a prescribed time period.

150. In my opinion, a skilled artisan would have been motivated to modify Tong's periodic transmission of channel quality information to transmit at a plurality of rates after reception of data, as taught by Zhang, for the reasons explained in Section XI.A.

C. Claim 3: "The method according to claim 2, wherein the prescribed time period includes a plurality of time intervals such that the channel quality information is reported at different ones of the plurality of rates during different ones of the plurality of time intervals."

151. In my opinion, Tong in combination with Zhang renders obvious claim 3. As explained for claim 3 of Ground 1 (Section VII.F), Zhang teaches transmitting at a plurality of rates over a plurality of time intervals.

152. In my opinion, a skilled artisan would have been motivated to modify Tong's periodic transmission of channel quality information to transmit at a

plurality of rates after reception of data, as taught by Zhang, for the reasons explained in Section XII.A.

XII. GROUND 6: TONG IN VIEW OF JACOBSMEYER RENDERS OBVIOUS CLAIMS 5, 6, AND 8

A. Claim 5: "The method according to claim 1, further comprising the step of estimating channel quality at the base station while the mobile station is reporting at the second rate, wherein estimated channel quality is used to derive a transmission format for a subsequent transmission."

153. In my opinion, Tong in view of Jacobsmeyer renders obvious claim 5, Tong renders obvious claim 1. Jacobsmeyer discloses the step of estimating channel quality to derive a transmission format (the data rate for future transmissions) as explained for claim 5 in Ground 2 (Section VIII.A).

154. In combination, a skilled artisan, in my opinion, would have been motivated to implement an estimator in Tong's base station to derive a new data rate (transmission format), as taught by Jacobsmeyer to "achieve greater throughput on [a] fading communication channel," Jacobsmeyer, 3:1-5, for the same reasons explained in Section VIII.A with reference to Kiang and Zhang—the same benefits would apply to combination with Tong.

B. Claim 6: "The method according to claim 5, wherein the transmission format includes one or more parameters selected from the group consisting of modulation format, number of codes, and transmission rate."

155. In my opinion, Tong in view of Jacobsmeyer renders obvious claim 6. As explained for claim 6 in Ground 2 (Section IX.B), Jacobsmeyer discloses a transmission format, including a data rate that is the rate of transmission for future transmissions over the channel.

156. In combination, in my opinion, a skilled artisan would have been motivated to implement an estimator to transmit a new data rate, as taught by Jacobsmeyer, which defines a transition format, as part of the channel quality information of Tong for the reasons explained in Section XII.A.

C. Claim 8: "The method according to claim 1, wherein the channel quality information comprises a transmission rate calculated by the mobile station based on one or more channel conditions."

157. In my opinion, Tong in view of Jacbosmeyer renders obvious claim 8. Additionally, in my opinion, Tong renders obvious claim 1. As explained for claim 8 in Ground 2 (Section IX.C). Jacobsmeyer discloses transmitting a data rate (transmission rate) calculated by the mobile station based on channel conditions.

158. In combination, in my opinion, a skilled artisan would have been motivated to implement an estimator in Tong's base station to derive a new data

rate (transmission rate), as taught by Jacobsmeyer, to be transmitted as part of the channel quality conditions of Tong for the reasons explained in Section XII.A.

XIII. GROUND 7: TONG IN VIEW OF JACOBSMEYER AND HORTENSIUS RENDERS OBVIOUS CLAIM 7

A. Claim 7

1. 7[a]: "The method according to claim 1, further comprising the step of estimating channel quality at the base station while the mobile station is reporting at the second rate,"

159. In my opinion, 7[a] is identical to claim 5 and rendered obvious by Tong in view of Jacobsmeyer and Hortensius for the same reasons (Section XII.A).

2. 7[b]: "wherein estimated channel quality is used to calculate an amount of redundancy needed for a retransmission of a previous data transmission."

160. In my opinion, Tong in view of Jacobsmeyer and Hortensius renders obvious 7[b]. As explained for 7[b] in Ground 3 (Section IX.A.2), Hortensius discloses calculating a repetition rate (an amount of redundancy needed).

161. In combination, in my opinion, a skilled artisan would have been motivated to implement an estimator in Tong's base station to derive a new data rate (transmission format), as taught by Jacobsmeyer for the reasons explained in Section XII.A. A skilled artisan would further have been motivated to implement the new data rate of Jacobsmeyer to further calculate a repetition rate (amount of

redundancy) "before the next data packet is sent" to ensure the appropriate retransmission of previous transmissions. Hortensius, 3:11-20.

162. Hortensius acknowledges that a "key concern[] in wireless communication systems is the sudden loss of a connection between two communicating stations … when [they] move out of reach of each other; i.e., one station's signal gets too weak for the other station to detect." *Id.*, 1:28-33. This concern would be realized in Tong and Jacobsmeyer as well, as each teaches mobile stations that may move out of reach of each other.

163. In my opinion, a skilled artisan would thus have been motivated to make this combination for the same reasons as the Kiang-Zhang combination with Jacobsmeyer and Hortensius explained in Section IX.A.2— the same benefits would apply to combination with Tong.

XIV. GROUND 8: TONG IN VIEW OF CHUNG RENDERS OBVIOUS CLAIMS 11-13

A. Claim 11

1. 11[preamble]: "A method for transmitting channel quality information in a wireless communication system including at least one base station and at least one mobile station, the method comprising:"

164. In my opinion, 11[preamble] is identical to claim 1[preamble] and disclosed by Tong for the same reasons (Section X.B.1).

2. 11[a]: "varying a rate for reporting channel quality information from a mobile station to a base station as a function of the number of base stations with which the mobile station is communicating."

165. In my opinion, Tong in combination with Chung renders obvious 1[a]. Tong teaches varying a rate for reporting channel quality information from a mobile station to a base station as explained for 1[a] (Section X.B.2) While Tong is silent regarding varying its rate for reporting channel quality information from a mobile station to a base station as a function of the number of base stations with which the mobile station is communicating, Tong recognizes that inter-sector or inter-cell interference adversely affects throughput for users located at the boundaries of cells where users receive signals from two (or more) base stations). *Id.*, [0012].

166. Chung addresses solutions for the same problem as Tong—increasing channel throughput—in the same field of endeavor—transmitting information in a wireless communication system including at least one base station and at least one mobile station. Chung, Abstract ("By controlling reverse rates among mobile stations to reduce reverse-link interference, reverse-link throughput can be increased"); 1:53-55 ("a BS 14, 20, 22 serves three sectors and communicates with multiple MS's 16, 18").

167. Chung teaches controlling the reverse link rate using a variable "MaxRate." 2:66-3:16. Chung also teaches that a mobile station can communicate with more than one base station when the mobile station is in "soft handoff." 2:52-56 ("A MS can communicate with several sectors. A MS is in soft handoff if decoding of the reverse packet is done at several sectors and an error-free frame, if any, is finally chosen."). Chung further teaches that "[w]hen a MS is in handoff, it gets several rate control commands from active sectors, and "[i]f all of the commands are 'up,' then the MS increases its MaxRate to two times its CurrentRate or 153.6 kbps, whichever is lower." Chung, 13:21-26.

168. Thus, Chung teaches varying a rate for reporting information from a mobile station to a base station as a function of the number of base stations with which the mobile station is communicating because Chung teaches that "the MS increases its MaxRate to two times its CurrentRate or 153.6 kbps" when the MS communicates with more than one base station. *Id.* And Chung teaches doing so "for increasing reverse throughput." Chung, 11:21-22.

169. In combination, a skilled artisan, in my opinion, would have been motivated to vary Tong's rate for reporting channel quality information from a mobile station to a base station as a function of the number of base stations with

which the mobile station is communicating, as taught by Chung, "for increasing reverse throughput." Chung, 11:21-22.

B. Claim 12: "The method according to claim 11, wherein the mobile station reports channel quality information at a first rate when the mobile station is communicating with one base station and wherein the mobile station reports channel quality information at a second rate when the mobile station is communicating with a plurality of base stations."

170. In my opinion, Tong in combination with Chung renders obvious claim 12. Chung teaches that its mobile station reports information at a first rate when the mobile station is communicating with one base station and its mobile station reports information at a second rate when the mobile station is communicating with a plurality of base stations. Chung, 13:21-26 ("[w]hen a MS is in handoff, it gets several rate control commands from active sectors, and "[i]f all of the commands are 'up,' then the MS increases its MaxRate to two times its CurrentRate or 153.6 kbps, whichever is lower"). And Chung teaches doing so "for increasing reverse throughput." *Id.*, 11:21-22.

171. In combination, a skilled artisan, in my opinion, would have been motivated to vary Tong's rate for reporting channel quality information from a mobile station to a base station, such that the mobile station reports channel quality information at a first rate when the mobile station is communicating with one base station and the mobile station reports channel quality information at a second rate

when the mobile station is communicating with a plurality of base stations, as taught by Chung, "for increasing reverse throughput." Chung, 11:21-22

C. Claim 13: "The method according to claim 12 wherein the second rate is faster than the first rate."

172. In my opinion, Tong in combination with Chung renders obvious claim 12. Chung teaches that its second rate is faster than its first rate. Chung, 13:21-26 ("[w]hen a MS is in handoff, it gets several rate control commands from active sectors, and "[i]f all of the commands are 'up,' then the MS increases its MaxRate to two times its CurrentRate or 153.6 kbps, whichever is lower"). And Chung teaches doing so "for increasing reverse throughput." *Id.*, 11:21-22.

173. In combination, in my opinion, a skilled artisan would have been motivated to vary Zhang's rate for reporting channel quality information from a mobile station to a base station, such that the second rate is faster than the first rate, as taught by Chung, "for increasing reverse throughput." *Id*.

XV. CONCLUSION

174. For the reasons set forth above, in my opinion, a person of ordinary skill in the art as described in paragraph 29 would have found the Challenged Claims of the '876 Patent obvious over the prior art.

175. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of

the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

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

Dated: January 30, 2023

Stephen Gray