

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

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT 7,477,876**

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Exhibit	Description
Ex. 1001	U.S. Patent No. 7,477,876 (“the ’876 patent”)
Ex. 1002	Prosecution History of the ’876 patent
Ex. 1003	Declaration of Expert Stephen Gray
Ex. 1004	Curriculum Vitae of Expert Stephen Gray
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 (“Jacobsmeier”)
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”)

I. Relief Requested

Petitioner requests *inter partes* review and cancellation of claims 1-13 (“the Challenged Claims”) of U.S. Patent No. 7,477,876 (the ’876 Patent) based on:

Exhibit/ Name	Number	Filing Date	Publication Date	Prior Art Provision
1005 “Kiang”	6,453,151	Jun. 21, 1999	Sep. 17, 2002	Pre-AIA 102(e)
1006 “Zhang”	2004/0013103	Jun. 27, 2001 (based on 1005 “Zhang Provisional)	Jan. 22, 2004	Pre-AIA 102(e)
1008 “Jacobsmeier”	5,541,955	Apr. 28, 1995	Jul. 30, 1996	Pre-AIA 102(a), (b), (e)
1009 “Hortensius”	6,252,854	Nov. 12, 1997	Jun. 26, 2001	Pre-AIA 102(a), (e)
1010 “Tong”	2001/0034236	Jan. 18, 2001	Oct. 25, 2001	Pre-AIA 102(a), (e)
1011 “Chung”	6,741,862	Feb. 7, 2001	May 25, 2004	Pre-AIA 102(e)

Claims 1-13 are unpatentable under the following grounds:

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 Jacobsmeier	§ 103
3	7	Kiang in view of Zhang, Jacobsmeier, 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 Jacobsmeier	§ 103
7	7	Tong in view of Jacobsmeier and Hortensius	§ 103
8	11-13	Tong in view of Chung	§ 103

II. The '876 Patent

A. Overview

The '876 patent discloses only a trivial modification, if even a modification at all, over the prior art—transmitting channel quality information at different rates based on whether a base station and mobile station are communicating data.

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. Ex. 1003, ¶ 36.

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; Ex. 1003, ¶ 37.

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. Ex. 1003, ¶ 38.

B. Prosecution History

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. Ex. 1001, 44. 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.” *Id.*, 45 (emphasis added); Ex. 1003, ¶¶ 39-40.

III. Level of Ordinary Skill

A person of ordinary skill in the art (“POSITA”) would have at least a bachelor’s degree in Electrical Engineering, Computer Science, Computer Engineering, or equivalent, and at least two years of prior experience in the wireless communication industry or comparable industry experience. Ex. 1003, ¶ 30. Additional education could substitute for professional experience and vice versa. *Id.*

IV. Claim Construction

The Board construes claims per *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). For this IPR, the plain meaning of each claim term can be applied. Ex. 1003, ¶ 35. Petitioner reserves the right to contend that any of the Challenged Claims is indefinite.

V. Ground 1: Kiang in view of Zhang Renders Obvious 1-4, 9, and 10

A. Kiang

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. Ex. 1003, ¶ 44.

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 Station Transceiver (BTS) when communication is established. Ex. 1003, ¶ 45.

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.**" Kiang, 5:33-36 (emphasis added); Ex. 1003, ¶ 46.

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].” *Kiang*, 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; Ex. 1003, ¶ 48

B. Zhang is Prior Art Based on its Provisional Application

Under *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1381 (Fed. Cir. 2015), a petitioner or requester may rely on the filing date of a provisional application for prior-art patent if it can show (1) the provisional application provides sufficient support for at least one claim in the patent (*Ex parte Mann*, 2016 WL 7487271, at *6 (PTAB Dec. 21, 2016)); and (2) the subject matter the petitioner or requester relies on in the prior-art patent is sufficiently supported in the provisional application. *Id.* at *5.

Zhang is prior art to the ’876 patent under 35 U.S.C. § 102(e) because (1) claim 19 is identical to claim 6 in its provisional application (U.S. Provisional Application No. 60/301,312, “Zhang Provisional”), and (2) the portions of *Zhang* relied on have sufficient support in *Zhang*’s provisional application.

1. Part 1: At Least Claim 19 of Zhang's Non-Provisional Is Supported in its Provisional

Zhang meets the first requirement because claim 19 of the non-provisional application is identical to claim of the provisional, and therefore supported.

Claim 19 of <i>Zhang</i>	Claim 6 of <i>Zhang</i> Provisional
19. A method of transmitting control information from a network apparatus to a plurality of mobile stations via a common control channel, the method comprising:	6. A method for transmitting control information from a network apparatus to a plurality of mobile stations via a common control channel, the method comprising:
transmitting control information to a first set of mobile stations at a first rate of transmission via the common control channel; and	transmitting control information to a first set of mobile stations at a first rate of transmission via the common control channel; and
transmitting control information to a second set of mobile stations at a second rate of transmission via the common control channel, the second rate of transmission being less than the first rate of transmission.	transmitting control information to a second set of mobile stations at a second rate of transmission via the common control channel, the second rate of transmission being less than the first rate of transmission.

2. Part 2: The Portions of Zhang Relied Upon Are Supported in Zhang's Provisional

In addition, the *Zhang* provisional supports the portions of the *Zhang* nonprovisional application that this Petition cites, as the following chart shows.

Cited Portions of <i>Zhang</i>	Supportive disclosure in the <i>Zhang</i> Provisional
[0016]: The method can include the step of switching between the first and second states of the terminal in dependence upon whether or not a data buffer for traffic communication with the terminal is empty.	5:4-31: The present invention, according to a fourth broad aspect, is a method of switching a mobile station from primary active user to a secondary active user. The method includes determining whether a data buffer for the mobile station at a network apparatus is in an empty condition; if the data buffer is in an empty condition, determining whether a switch condition is detected; and if the switch condition is detected, triggering the mobile station to be switched from a primary active user to a secondary active user. In one case, the determining whether a switch condition is detected comprises determining whether an empty buffer indication from the mobile station has been received. In another case, the determining whether a switch condition is detected comprises determining whether the data buffer is in an empty

	condition for a predetermined period of time. In another aspect, the present invention is an apparatus for switching a mobile station from a primary active user to a secondary active user. The apparatus includes means for determining whether a data buffer for the mobile station at a network apparatus is in an empty condition; means for determining whether a switch condition is detected if the data buffer is in an empty condition; and means for triggering the mobile station to be switched from a primary active user to a secondary active user if the switch condition is detected.
[0026]: According to another aspect, the invention provides a wireless communications System comprising: first and second sets of mobile stations; and an apparatus that operates to transmit control information to, and/or to receive control information from, the first and second sets of mobile stations at respective first and second rates of	4:29-5:3: The present invention, according to a third broad aspect, is a wireless network including first and second sets of mobile stations; and an apparatus that operates to transmit control information to the first and second sets of mobile stations at respective first

transmission via a shared control channel, the second rate of transmission being less than the first rate of transmission. The shared control channel can comprise a power control channel for controlling power of the mobile stations.	and second rates of transmission via a common control channel, the second rate of transmission being less than the first rate of transmission.
[0031]: In an embodiment of the invention described in detail below with reference to the drawings, an active user can be in an active state or a control hold state. The active state of an active user is also referred to as a primary active state, and the control hold state of an active user is also referred to as a secondary active state. The control hold state generally corresponds to situations in which there is temporarily no packet data being communicated between the BS and the MS of an active user, i.e. in which data buffers are empty. Transitions between the active state and the control hold state can therefore be dependent upon whether or not data	3:1-10: Using the control hold mode method, after the data buffer within an active user becomes empty for some period of time, the high rate supplemental channel is released and both forward and reverse dedicated control channels only send pilot and power control sub-channels in both directions with either full rate or a reduced rate. The purpose of this mode is to rate-reduce operations to save battery power. 5:4-20: The present invention, according to a fourth broad aspect, is a method of switching a mobile station from a primary active user to a secondary active user. The method includes determining whether a data

buffers are empty, or can be directed by the system.	buffer for the mobile station at a network apparatus is in an empty condition; if the data buffer is in an empty condition, determining whether a switch condition is detected; and if the switch condition is detected, triggering the mobile station to be switched from a primary active user to a secondary active user. In one case, the determining whether a switch condition is detected comprises determining whether an empty buffer indication from the mobile station has been received. In another case, the determining whether a switch condition is detected comprises determining whether the data buffer is in an empty condition for a predetermined period of time.
[0032]: An active user in this embodiment of the invention refers to a mobile station (MS), and the description below refers particularly to high rate packet data communications to the MS on the forward link from a base station	2:30-3:2: In current cdma2000 systems, an active data user is assigned a forward dedicated control channel/fundamental channel, reverse dedicated control channel/fundamental channel and supplemental channels on

(BS), and power control for communications on the reverse link from the MS to the BS. However, it can be appreciated that these particulars are provided by way of example and not limitation, and that the invention can also be applied to other shared communications channels for traffic and/or control (including feedback, pilot, and any other overhead) information in either direction or in both directions between base stations and remote terminals.	either forward link only or reverse link only or both. 4:17-28: The present invention, according to a second broad aspect, is a method for transmitting control information from a network apparatus to a plurality of mobile stations via a common control channel. The method includes transmitting control information first set of mobile stations at a first rate of transmission via the common control channel; and transmitting control information to a second set mobile stations at a second rate of transmission the common control channel, the second rate of transmission being less than the first rate of transmission.
[0034]: Also in the described embodiment of the invention it is assumed that the time slot duration is 1.25 ms, the time slots having a rate of 800 Hz which is referred to as the full rate. Other, lower, rates referred to	7:8-15: Secondary active user (reduced rate mode): monitors F-SCCH all the time, monitors its power control sub-channel and sends feedback at lower rate than the full rate. In some embodiments, the secondary active

below are conveniently sub-multiples of the full rate, for example $\frac{1}{2}$ (half), $\frac{1}{4}$ (quarter), and $\frac{1}{8}$ (eighth) rates being 400, 200, and 100 Hz respectively and corresponding to one in every two, four, and eight time slots respectively. However, it can be appreciated that these parameters are given only by way of example.	users could have various reduced rates such as $\frac{1}{2}$ rate (half rate active user), or $\frac{1}{4}$ rate (1/4 rate active user) or $\frac{1}{8}$ rate (1/8 rate active user).
[0038]: As a result of the reduced rates used in the control hold state, in accordance with embodiments of this invention system resources that previously could be used by only one active user can be shared by a plurality of active users each in the control hold state, so that a greater total number of active users can be simultaneously supported by the system. Transitions between the active state and the control hold state for each active user can take place relatively rapidly (compared with switching between idle and active states), as described further below.	3:16-27: The present invention is directed to an enhancement to the concept of the control hold mode. The purpose of this enhancement is not only to save battery power but also to dynamically share active users' resources and enable an increase in the number of active users without adding significant additional resource consumption. This could eventually lead to an increase in the system aggregated forward link throughput. In embodiments of the present invention, 25 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. 4:3-7: The grouping of users into these sets that receive control information at different rates, allows for a more efficient use of resources and allow more active users to be supported within the system.
[0041]: As illustrated in FIG. 1, the MS in the active state transmits its pilot and feedback information in each time slot in the dedicated reverse link channels.	3:1-10: Using the control hold mode method, after the data buffer within an active user becomes empty for some period of time, the high rate supplemental channel is released and both forward and reverse dedicated control channels only send pilot and power control sub-channels in both directions with either full rate or a reduced rate. The purpose of this mode is to rate-reduce operations to save battery power.
[0050]: For example, in an embodiment of the invention, if a data buffer, for sending data on the forward link to an MS in the active state, becomes empty	8:29-9:21: For each of the above configurations, the percentiles of primary active users and various rate secondary active users supported

as a result of a data packet being sent from the BS to the MS, the Layer 2 frame header of this packet can include a buffer empty indication (1 bit) and information (a mode control field) regarding the control hold state. In response to receipt of the forward link buffer empty indication, the MS in the active state replies by indicating whether or not the sending data buffer at the MS is also empty. If it is empty, the active user is switched from the active state to the control hold state immediately after the response from the MS is received. Otherwise, the MS remains in the active state.	among active users are fixed, but could be dynamically changing. For instance, the configuration can be dynamically changed based on real time traffic load of the active users. The updated configuration information can be sent on FSCCH. There are a number of different techniques according to the present invention for switching a mobile station from a primary active user to a secondary active user. In one embodiment, if a primary user's data buffer at the base station becomes empty after the network sends a packet to the user, the layer 2 frame header of this packet includes a buffer empty indication (1bit) and corresponding information (mode control field) regarding the enhanced control hold mode. After receiving the forward link buffer empty indication, the mobile station of a primary active user replies to this by indicating whether the data buffer at the mobile station side is empty or not. If the mobile station's
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	buffer is empty too, the primary active user is switched to a secondary active user immediately after the response from the mobile is received. Otherwise, the user remains in its full rate mode.
[0051]: Alternatively, a timer can be set with a very small value when the data buffer for sending data to the MS in the active state becomes empty. When the set time ends, or at any other time that the network considers appropriate, the network can for example send a control message in the Layer 2 frame header to explicitly request the MS to switch to the control hold mode. Alternatively, Layer 3 signaling can be used to trigger a switch of an active user from the active state to the control hold state.	9:22-31: In an alternative embodiment of the present 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 user.
[0052]-[0054]: By way of example of a mode control field in the Layer 2 frame header as mentioned above, such a mode control field can comprise a time slot indicator and a sub-channel indicator, and optionally a reduced rate indicator. For example, for the	10:20-11:7: For configuration 3: Reduced rate indicator (1 bit): indicates whether $\frac{1}{4}$ rate or $\frac{1}{8}$ rate the secondary active user should use. For a $\frac{1}{4}$ rate secondary active user:

configuration described above with reference to FIG. 3 with a reduced rate of $\frac{1}{8}$, the time slot indicator may comprise 3 bits to indicate which time slot, in a sequence of 8 time slots in the 10 ms cycle, is to be used by the MS in the control hold state, and the sub-channel indicator may comprise 2 bits to indicate which of the 4 bits of the field 16 is to be used by the MS for its reduced rate power control sub-channel. Similarly, for the configuration described above with reference to FIG. 4 with a reduced rate of $\frac{1}{4}$, the time slot indicator may comprise 2 bits to indicate which time slot, in a sequence of 4 time slots in the 5 ms cycle, is to be used by the MS in the control hold state, and the sub-channel indicator may comprise 3 bits to indicate which of the 8 bits of the field 16 is to be used by the MS for its reduced rate power control sub-channel. Also, for the configuration described above with reference to FIG. 5 with alternative reduced rates of $\frac{1}{8}$ and	Slot indicator (2 bits): indicates the slot among the 4 slots within a 5ms-cycle, in which, the power control sub-channel of the secondary active user is to be sent. Sub-channel indicator (2 bits): indicates the secondary active user's power control sub-channel in the 4-bit secondary power control field. For a $\frac{1}{8}$ rate secondary active user: Slot indicator (3 bits): indicates the slot among the 8 slots within a 10ms-cycle, in which, the power control sub-channel of a secondary active user is to be sent. Sub-channel indicator (2 bits): indicates the secondary active user's power control sub-channel in the 4-bit secondary power control field.
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$\frac{1}{4}$, there may be a 1-bit reduced rate indicator to indicate to the MS which of the two reduced rates is to be used, the time slot indicator may comprise 2 or 3 bits to indicate which time slot, in a sequence of either 4 or 8 time slots for the $\frac{1}{4}$ and $\frac{1}{8}$ reduced rates respectively, is to be used by the MS, and the sub-channel indicator may comprise 2 bits in each case to indicate which of the respective 4 bits of the field 16 is to be used by the MS for its reduced rate power control sub-channel.	
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C. Summary of the Combination

1. Summary of the Kiang-Zhang Combination

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. 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. Ex. 1003, ¶ 49.

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, the 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]. 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]; Ex. 1003, ¶¶ 50-51.

A POSITA 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; Ex. 1003, ¶ 52.

2. Kiang and Zhang are Analogous Art and Combinable

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; Ex. 1003, ¶ 53.

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; Ex. 1003, ¶ 54.

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]; Ex. 1003, ¶ 55.

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. Ex. 1003, ¶ 56.

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

A POSITA 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. Ex. 1003, ¶ 57.

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. A POSITA reviewing Kiang would therefore 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. Ex. 1003, ¶ 58.

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]. A POSITA 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. Ex. 1003, ¶ 59.

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, 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]. 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 as would have been readily apparent to a POSITA. Ex. 1003, ¶¶ 60-61.

Second, because the combination of Zhang's varied rates into Kiang's system reduces power consumption, a POSITA 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, a POSITA 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]; Ex. 1003, ¶ 62.

A POSITA 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. Ex. 1003, ¶ 63.

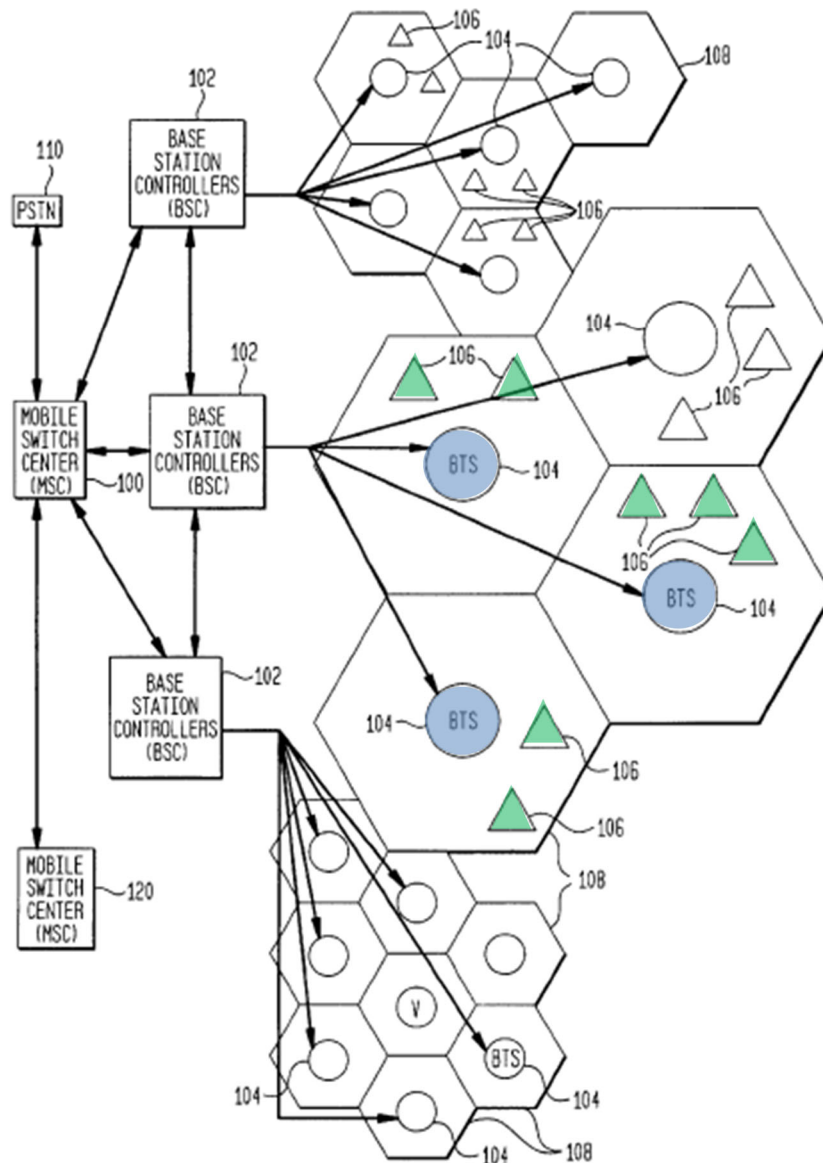
D. Claim 1

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:”**

Kiang discloses 1[preamble]. Ex. 1003, ¶ 64.

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; Ex. 1003, ¶ 64.

FIG. 1



Kiang, FIG. 1 (annotated).

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; Ex. 1003, ¶ 65.

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,”

Kiang in combination with Zhang renders obvious 1[a]. Ex. 1003, ¶ 66.

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). Ex. 1003, ¶ 66.

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; Ex. 1003, ¶ 67.

A POSITA 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. Ex. 1003, ¶ 68.

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.*; Ex. 1003, ¶ 69.

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. Ex. 1003, ¶ 70.

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. Ex. 1003, ¶ 71.

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]. 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]; Ex. 1003, ¶¶ 72-73.

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]. 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). Ex. 1003, ¶¶ 74-75.

A POSITA 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 VI.B. Ex. 1003, ¶ 76

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,”

Kiang in combination with Zhang renders obvious 1[b]. Ex. 1003, ¶ 77.

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). 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. Ex. 1003, ¶¶ 77-78.

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 POSITA would have understood that the buffer monitored would be a buffer at Kiang's mobile station. Ex. 1003, ¶ 79.

A POSITA 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 V.C. Ex. 1003, ¶ 80.

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.”

Kiang in combination with Zhang renders obvious 1[c]. Ex. 1003, ¶ 81.

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). 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 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. Ex. 1003, ¶¶ 81-82.

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, 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). Ex. 1003, ¶ 83.

Zhang also discloses that the active state and second rate are applied for a prescribed duration for two reasons. Ex. 1003, ¶ 84.

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]. Ex. 1003, ¶ 84.

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 POSITA would have understood that the buffer monitored would be a buffer at Kiang’s mobile station. Ex. 1003, ¶ 85.

A POSITA 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 V.C. Ex. 1003, ¶ 86.

E. 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:”**

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. Kiang in combination with Zhang renders obvious renders obvious 9[preamble] for the reasons explained for 1[preamble] (Section V.D.1) and 1[a] (Section V.D.2). Ex. 1003, ¶ 87.

- 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”

9[a] is substantially similar to 1[b]. Kiang in combination with Zhang renders obvious 9[a] for the reasons explained for 1[b] (Section V.D.3). Ex. 1003, ¶ 88.

- 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.”**

9[b] is substantially similar to 1[c]. Kiang in combination with Zhang renders obvious 9[b] for the reasons explained for 1[c] (Section V.D.4). Ex. 1003, ¶ 89.

- F. 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.”

Kiang in combination with Zhang renders obvious 2[a]. Ex. 1003, ¶ 90.

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]. Ex. 1003, ¶ 90.

Therefore, a POSITA 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. Ex. 1003, ¶ 91.

A POSITA would further have 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. A POSITA 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. Ex. 1003, ¶ 92.

A POSITA would have been motivated to 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 V.C. Ex. 1003, ¶ 93.

G. 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.”

Kiang in combination with Zhang renders obvious claim 3. Ex. 1003, ¶ 94.

As explained for claim 2 (Section V.F), 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,” a POSITA 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). Therefore, 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). Ex. 1003, ¶¶ 94-95.

A POSITA would have been motivated to 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 V.C. Ex. 1003, ¶ 96.

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

Kiang in combination with Zhang renders obvious claims 4 and 10. As explained for 1[a]-1[c] (Sections V.D.2-V.D.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). Ex. 1003, ¶ 97.

VI. 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.”

Kiang in view of Zhang and Jacobsmeyer renders obvious claim 5. Ex. 1003, ¶ 98.

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). Ex. 1003, ¶ 99.

Jacobsmeier, like the '876 patent, Kiang, and Zhang, discloses a wireless communication system, including mobile stations and base stations, directed to “achieving greater throughput.” Jacobsmeier, 3:1-5. Jacobsmeier is thus analogous. Ex. 1003, ¶ 100.

Jacobsmeier discloses an “[e]stimator 70 connected to a return channel transmitter 78.” Jacobsmeier, 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.” Jacobsmeier, 11:51-54; Ex. 1003, ¶ 101.

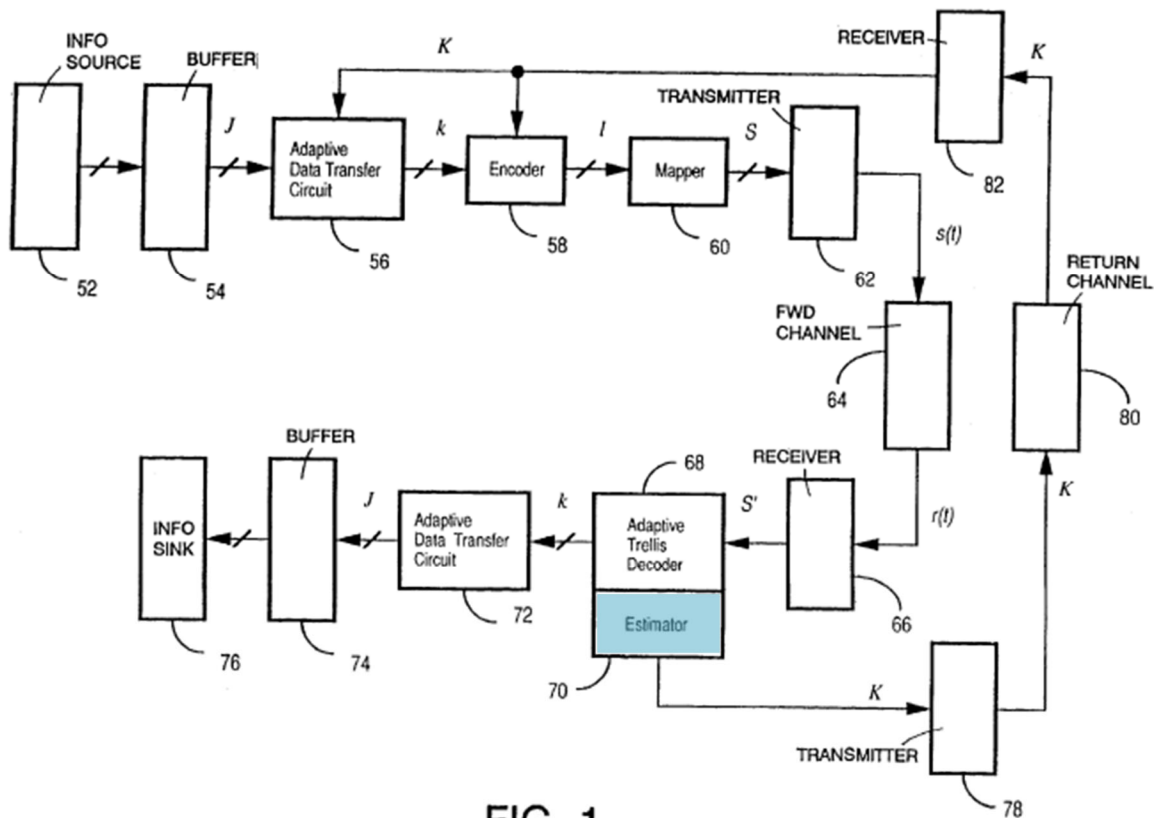


FIG. 1

Jacobsmeier, FIG. 1 (annotated).

Jacobsmeier'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. Jacobsmeier, 6:15-18 (“data rate, or throughput, of a communications channel”); Ex. 1001, Claim 6 (defining transmission format as including “transmission rate”); Ex. 1003, ¶ 102.

In combination, a POSITA would have been motivated to implement an estimator in Kiang's base station to derive a new data rate (transmission format), as taught by Jacobsmeier to “achieve greater throughput on [a] fading communication channel.” Jacobsmeier, 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. The benefits of doing so, however, would have been obvious, as expressly described by Jacobsmeier—“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”. Jacobsmeier, 11:51-52, 3:5-1. It therefore would have been obvious to a POSITA to implement Jacobsmeier'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.

Ex. 1003, ¶¶ 103-105.

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.”

Kiang in view of Zhang and Jacobsmeyer renders obvious claim 5. Ex. 1003, ¶ 106.

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; Section VI.A. 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”); Ex. 1003, ¶ 107.

In combination, in addition to the channel strength transmitted by Kiang, a POSITA 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 VI.A. Ex. 1003, ¶ 108.

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.”

Kiang in view of Zhang and Jacobsmeyer renders obvious claim 8. Ex. 1003, ¶ 109.

Kiang in view of Zhang renders obvious claim 1. Jacobsmeyer discloses transmitting a data rate (transmission rate) calculated by the mobile station based on channel conditions. Ex. 1003, ¶ 110.

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; Ex. 1003, ¶ 111.

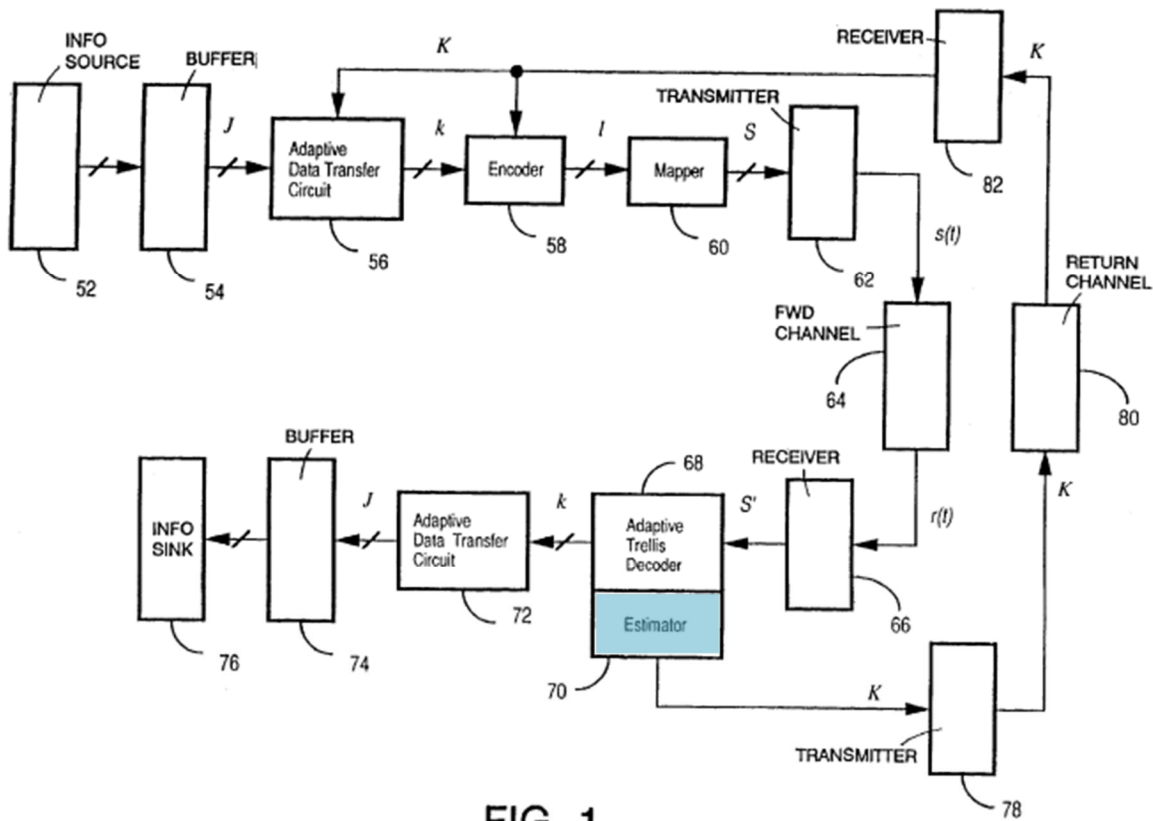


FIG. 1

Jacobsmeier, FIG. 1 (annotated).

Jacobsmeier's data rate is the claimed transmission rate because Jacobsmeier's data rate is the rate of transmission for future transmissions over the channel. Jacobsmeier, 6:15-18 ("data rate, or throughput, of a communications channel"); Ex. 1003, ¶ 112.

In combination, in addition to the channel strength transmitted by Kiang, a POSITA 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 VI.A. Ex. 1003, ¶ 113.

VII. 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,”**

7[a] is identical to claim 5 and rendered obvious by Kiang in view of Zhang, Jacobsmeyer, and Hortensius for the same reasons (Section VI.A). Ex. 1003, ¶ 114.

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

Kiang in view of Zhang, Jacobsmeyer, and Hortensius renders obvious 7[b]. Ex. 1003, ¶ 115.

Hortensius, like the '876 patent, Kiang, Zhang, and Jacobsmeyer, discloses a wireless communication system, including mobile stations and base stations. Hortensius, Abstract. Hortensius is thus analogous. Ex. 1003, ¶ 116.

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; Ex. 1003, ¶ 117.

In combination, a POSITA 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 VI.A. A POSITA 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; Ex. 1003, ¶ 118.

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. Hortensius's repetition rate would address this problem, thus motivating a POSITA to implement Hortensius's repetition rate in the combination, and a POSITA 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). Ex. 1003, ¶¶ 119-120.

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

A. Tong

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. Ex. 1003, ¶ 121.

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.*; Ex. 1003, ¶ 122.

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:”**

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]; Ex. 1003, ¶ 123.

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,”**

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). Ex. 1003, ¶ 124.

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.* 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.* 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.*; Ex. 1003, ¶¶ 125-126.

A POSITA 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. Ex. 1003, ¶ 127.

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,”

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. Ex. 1003, ¶ 128.

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.* 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.* 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.*; Ex. 1003, ¶¶ 129-130.

A POSITA 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. Ex. 1003, ¶ 131.

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.”

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. Ex. 1003, ¶ 132.

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.*; Ex. 1003, ¶ 133.

A POSITA 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. Ex. 1003, ¶ 134.

Tong further discloses that this rate is used for a prescribed duration for two reasons. **First**, because Tong discloses slot cycles, a POSITA 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 POSITA would have understood that Tong would use the first rate of once per slot cycle until data is not received—also a prescribed duration. Ex. 1003, ¶ 135.

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:”**

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 VIII.B.1) and 1[a] (Section VIII.B.2). Ex. 1003, ¶ 136.

- 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”**

9[a] is substantially similar to 1[b]. Tong discloses or renders obvious 9[a] for the reasons explained for 1[b] (Section VIII.B.3). Ex. 1003, ¶ 137.

- 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.”**

9[b] is substantially similar to 1[c]. Tong discloses or renders obvious 9[b] for the reasons explained for 1[c] (Section VIII.B.4). Ex. 1003, ¶ 138.

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

Tong renders obvious claims 4 and 10. As explained for 1[a]-1[c] (Sections VIII.B.2-VIII.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). Ex. 1003, ¶ 139.

IX. 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

As explained in Section VIII.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. Ex. 1003, ¶ 140.

Zhang discloses assigning various groups of secondary active state users, each with a separate reduced reporting rate. A POSITA 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 V.C.3, Zhang's exemplary discussion of downlink transmissions is inconsequential in combination because a POSITA would have understood Zhang's method to apply equally to either a base station or a mobile station. Ex. 1003, ¶ 141.

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

A POSITA 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. Ex. 1003, ¶ 142.

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.*; Ex. 1003, ¶ 143.

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. A POSITA 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. Ex. 1003, ¶¶ 144-145.

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]; Ex. 1003, ¶ 146.

A POSITA 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. Tong, [0013] (explaining that there is a need to increase data throughput capacity in a wireless network), [0062] (noting that a battery powers the RF unit for each mobile station). Ex. 1003, ¶ 147.

A POSITA 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. Ex. 1003, ¶ 148.

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.”

Tong in combination with Zhang renders obvious 2[a]. Ex. 1003, ¶ 149.

As explained for claim 2 of Ground 1 (Section V.F), Zhang teaches using a plurality of rates for transmitting channel quality information over a prescribed time period. Ex. 1003, ¶ 149.

A POSITA 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 IX.A. Ex. 1003, ¶ 150.

- 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.”**

Tong in combination with Zhang renders obvious claim 3. Ex. 1003, ¶ 151.

As explained for claim 3 of Ground 1 (Section V.G), Zhang teaches transmitting at a plurality of rates over a plurality of time intervals. Ex. 1003, ¶ 151.

A POSITA 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 IX.A. Ex. 1003, ¶ 152.

X. 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.”**

Tong in view of Jacobsmeyer renders obvious claim 5. Ex. 1003, ¶ 153.

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 VI.A). Ex. 1003, ¶ 153.

In combination, a POSITA 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 VI.A with reference to Kiang and Zhang—the same benefits would apply to combination with Tong. Ex. 1003, ¶ 154.

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."

Tong in view of Jacobsmeyer renders obvious claim 6. Ex. 1003, ¶ 155.

As explained for claim 6 in Ground 2 (Section VI.B), Jacobsmeyer discloses a transmission format, including a data rate that is the rate of transmission for future transmissions over the channel. Ex. 1003, ¶ 155.

In combination, a POSITA 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 X.A. Ex. 1003, ¶ 156.

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.”

Tong in view of Jacobsmeyer renders obvious claim 8. Ex. 1003, ¶ 157.

Tong renders obvious claim 1. As explained for claim 8 in Ground 2 (Section VI.C) Jacobsmeyer discloses transmitting a data rate (transmission rate) calculated by the mobile station based on channel conditions. Ex. 1003, ¶ 157.

In combination, a POSITA 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 X.A. Ex. 1003, ¶ 158.

XI. 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,”**

7[a] is identical to claim 5 and rendered obvious by Tong in view of Jacobsmeyer and Hortensius for the same reasons (Section X.A). Ex. 1003, ¶ 159.

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

Tong in view of Jacobsmeyer and Hortensius renders obvious 7[b]. Ex. 1003, ¶ 160.

As explained for 7[b] in Ground 3 (Section VII.A.2), Hortensius discloses calculating a repetition rate (an amount of redundancy needed). Ex. 1003, ¶ 160.

In combination, a POSITA 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 X.A. A POSITA 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; Ex. 1003, ¶ 161.

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. A POSITA 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 VII.A.2— the same benefits would apply to combination with Tong. Ex. 1003, ¶¶ 162-163.

XII. Ground 8: Tong in view of Chung (US 6,741,862 B2) 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:”**

11[preamble] is identical to claim 1[preamble] and disclosed by Tong for the same reasons (Section VIII.B.1). Ex. 1003, ¶ 164.

- 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.”**

Tong in combination with Chung renders obvious 1[a]. Ex. 1003, ¶ 165.

Tong teaches varying a rate for reporting channel quality information from a mobile station to a base station as explained for 1[a] (Section VIII.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]; Ex. 1003, ¶ 165.

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”). 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; Ex. 1003, ¶¶ 166-167.

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.” *Id.*, 11:21-22; Ex. 1003, ¶ 168.

In combination, a POSITA 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; Ex. 1003, ¶ 169.

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.”

Tong in combination with Chung renders obvious claim 12. Ex. 1003, ¶ 170.

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; Ex. 1003, ¶ 170.

Thus, in combination, a POSITA 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; Ex. 1003, ¶ 171.

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

Tong in combination with Chung renders obvious claim 12. Ex. 1003, ¶ 172.

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; Ex. 1003, ¶ 172.

In combination, a POSITA 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.” Chung, 11:21-22; Ex. 1003, ¶ 173.

XIII. Non-Institution Under 35 U.S.C. §§ 314 Is Improper

At this time, no factors articulated in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 5-6 (PTAB Mar. 20, 2020), weigh in favor of non-institution under 35 U.S.C. § 314(a) because no trial date has been set in the parallel litigation and the parallel litigation is administratively stayed pending proper service of the complaint.

XIV. Institution Under 35 U.S.C. § 325(d) Is Appropriate in View of New References and Arguments

Non-institution under § 325(d) would also be improper. The prior art and grounds in this Petition were not previously considered by the Office and are materially different and not cumulative of what was previously considered.

XV. Mandatory Notices

A. Real Parties-in-Interest

The real parties-in-interest for this Petition are ZTE (USA) Inc. and ZTE Corporation.

B. Related Matters

To Petitioner’s knowledge, the ’876 Patent is involved in the following:

Name	Number	Court	Filed
<i>WSOU Investments, LLC d/b/a Brazos Licensing and Development v. ZTE Corporation</i>	6:22-cv-00138	W.D. Tex.	February 8, 2022
<i>WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Oneplus Technology (Shenzhen Co., Ltd.</i>	6:20-cv-00956	W.D. Tex.	October 14, 2020

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D. Service Information

Please address correspondence to counsel at the addresses above and ZTE-WSOU-IPRs@finnegan.com. Petitioner consents to service by e-mail.

XVI. Standing

The '876 Patent is eligible for *inter partes* review and Petitioner is not barred or estopped from requesting review.

XVII. Conclusion

Petitioner has established a reasonable likelihood of success and requests the Board institute review and cancel the Challenged Claims.

Dated: February 8, 2023

Respectfully submitted,

/Lionel M. Lavenue/

Lionel M. Lavenue, Lead Counsel
Reg. No. 46,859

CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

Pursuant to 37 C.F.R. § 42.24(a)(1)(i), the undersigned hereby certifies that the foregoing **Petition for *Inter Partes* Review** contains 13,565 words, excluding the parts of this Petition that are exempted under 37 C.F.R. § 42.24(a), as measured by the word-processing system used to prepare this paper.

/Lionel M. Lavenue/

Lionel M. Lavenue, Lead Counsel
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CERTIFICATE OF SERVICE

The undersigned certifies that the foregoing **Petition for *Inter Partes* Review**, the associated **Power of Attorney**, and **Exhibits 1001 through 1011** are being served on February 8, 2023, by FedEx Priority Overnight® at the following address of record for the subject patent.

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