

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMERICAN AIRLINES, INC.

and

SOUTHWEST AIRLINES CO.,

Petitioners

v.

INTELLECTUAL VENTURES II LLC,

Patent Owner

IPR2025-01509

U.S. Patent No. 11,032,000

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,032,000**

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 11,032,000 (the “’000 Patent”)
1002	File History for U.S. Patent No. 11,032,000 (U.S. Patent Appl. No. 16/682,854)
1003	Declaration of Dr. van der Weide
1004	Curriculum Vitae of Dr. van der Weide
1005	U.S. Patent No. 8,417,248 (“Papasakellariou”)
1006	US Patent Application Publication No. 2007/0058595 (“Classon”)
1007	US Patent No. 7,817,605 (“Liu”)
1008	US Patent Application Publication No. 2008/0045260 (“Muharemovic”)
1009	Claim Chart for ’000 Patent, <i>Intellectual Ventures I LLC et al. v. American Airlines, Inc.</i> , No. 4:24-cv-980-ALM (E.D. Tex. Nov. 2, 2024) (Exhibit 13) (’000 claim chart)
1010	<i>Toyota Motor Corp. et al. v. Intellectual Ventures II LLC</i> , IPR2022-01130, Paper 1 (P.T.A.B. Jun. 13, 2022) (the “’356 Petition”)
1011	<i>Toyota Motor Corp. et al. v. Intellectual Ventures II LLC</i> , IPR2022-01130, Paper 10 (P.T.A.B. Oct. 5, 2022) (the “’356 POPR”)
1012	<i>Toyota Motor Corp. et al. v. Intellectual Ventures II LLC</i> , IPR2022-01130, Paper 26 (P.T.A.B. Apr. 7, 2023) (the “’356 POR”)
1013	<i>Toyota Motor Corp. et al. v. Intellectual Ventures II LLC</i> , IPR2022-01130, Paper 13 (P.T.A.B. Dec. 12, 2022) (the “’356 Institution”)
1014	<i>Toyota Motor Corp. et al. v. Intellectual Ventures II LLC</i> , IPR2022-01130, Paper 41 (P.T.A.B. Dec. 4, 2023) (the “’356 FWD”)
1015	“LTE – The UMTS Long Term Evolution: From Theory to Practice” by Sesia, Toufik, and Baker, published by Wiley in 2009.
1016	US Patent No. 7,668,564 (“Onggosanusi”)
1017	<i>Intellectual Ventures I LLC et al. v. American Airlines, Inc.</i> , No. 4:24-cv-980 (E.D. Tex.) [Dkt. 76] – Amended Complaint
1018	<i>Intellectual Ventures I LLC et al. v. Southwest Airlines Co.</i> , No. 7:24-cv-277 (W.D. Tex.) [Dkt. 1] – Complaint
1019	<i>Intellectual Ventures I LLC et al. v. American Airlines, Inc.</i> , No. 25-cv-576 (E.D. Tex.) [Dkt.1] – Complaint
1020	Intentionally not used
1021	Approved report of 3GPP TSG RAN WG1 #46
1022	Approved report of 3GPP TSG RAN WG1 #45
1023	Approved report of 3GPP TSG RAN WG1 #44

1024	Approved report of 3GPP TSG RAN WG1 #43
1025	Approved report of 3GPP TSG RAN WG1 #42bis
1026	Intentionally not used
1027	Intentionally not used
1028	Intentionally not used
1029	Declaration of Paul Howard dated March 29, 2014

LISTING OF CHALLENGED CLAIMS

Claim 1	
1[pre]	A user equipment (UE) comprising:
1[a]	a receiver and a processor are configured to receive resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;
1[b]	a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals;
1[c]	the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and
1[d]	the receiver and the processor are further configured to receive, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.
Claim 2	
2	The UE of claim 1, wherein the receiver and the processor are further configured to receive data on a physical downlink shared channel.
Claim 3	
3	The UE of claim 2, wherein the physical control channel and the physical downlink shared channel are time multiplexed.
Claim 4	
4	The UE of claim 1, wherein the receiver and the processor are further configured to receive, on the physical control channel, power control information.
Claim 5	
5	The UE of claim 4, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

Claim 6	
6	The UE of claim 1, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.
Claim 7	
7[pre]	A network device comprising:
7[a]	a transmitter and a processor are configured to transmit resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;
7[b]	a receiver and the processor are further configured to receive, over the physical uplink shared channel, data in assigned time intervals;
7[c]	the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and
7[d]	the transmitter and the processor are further configured to transmit, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.
Claim 8	
8	The network device of claim 7, wherein the transmitter and the processor are further configured to transmit data on a physical downlink shared channel.
Claim 9	
9	The network device of claim 8, wherein the physical control channel and the physical downlink shared channel are time multiplexed.
Claim 10	
10	The network device of claim 7, wherein the transmitter and the processor are further configured to transmit, on the physical control channel, power control information.

Claim 11	
11	The network device of claim 10, wherein the physical control channel includes power control information for a plurality of UEs using different bits.
Claim 12	
12	The network device of claim 7, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.
Claim 13	
13[pre]	A method performed by user equipment (UE), the method comprising:
13[a]	receiving resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;
13[b]	sending, over the physical uplink shared channel, data in assigned time intervals;
13[c]	sending, in a time interval that it is not sending information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and
13[d]	receiving, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.
Claim 14	
14	The method of claim 13 further comprising receiving data on a physical downlink shared channel.
Claim 15	
15	The method of claim 14, wherein the physical control channel and the physical downlink shared channel are time multiplexed.
Claim 16	
16	The method of claim 13 further comprising receiving, on the physical control channel, power control information.

Claim 17	
17	The method of claim 16, wherein the physical control channel includes power control information for a plurality of UEs using different bits.
Claim 18	
18	The method of claim 13, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.
Claim 19	
19[pre]	A method performed by a network device, the method comprising:
19[a]	transmitting resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;
19[b]	receiving, over the physical uplink shared channel, data in assigned time intervals;
19[c]	receiving, in a time interval that it is not receiving information over the physical uplink shared channel, the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and
19[d]	transmitting, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.
Claim 20	
20	The method of claim 19 further comprising transmitting data on a physical downlink shared channel.
Claim 21	
21	The method of claim 20, wherein the physical control channel and the physical downlink shared channel are time multiplexed.
Claim 22	
22	The method of claim 19 further comprising transmitting, on the physical control channel, power control information.
Claim 23	

23	The method of claim 22, wherein the physical control channel includes power control information for a plurality of UEs using different bits.
Claim 24	
24	The method of claim 19, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

I. INTRODUCTION

American Airlines, Inc. and Southwest Airlines Co. (“Petitioners”) request *inter partes* review (“IPR”) of claims 1-24 (the “challenged claims”) of U.S. Patent No. 11,032,000 titled “Communications in a Wireless Network” (the “’000 Patent,” Ex-1001).

II. GROUNDS FOR STANDING

Petitioners certify the ’000 Patent is available for IPR and Petitioners are not barred or estopped from requesting IPR on the grounds herein. Petitioners filed this Petition within one-year of service of Patent Owner’s district court complaint alleging infringement of the ’000 Patent. Ex-1017; Ex-1018.

III. CHALLENGED GROUNDS

Petitioners request IPR and cancellation of the challenged claims of the ’000 Patent on the following grounds:¹

Ground	Claims	Basis	References
1	1-24	§ 103	Papasakellariou, Classon, and Liu
2	1-24	§ 103	Muharemovic, Onggosanusi, and Classon

¹ All references to 35 U.S.C. §§ 102, 103 are to the pre-AIA statutory framework.

Petitioners also stipulate that, if trial is instituted, Petitioners will not pursue in the District Court Litigation any ground raised or that could have been reasonably raised in an IPR. *Sotera*, Paper 12 at 18.

The '000 Patent application (U.S. Patent App. No. 16/682,854) was filed on November 13, 2019 and claims priority to December 27, 2006. Ex-1001, 1-2. Every prior art reference in the above grounds precedes the '000 Patent's priority date.²

² The application leading to U.S. Patent No. 8,811,356 (the "'356 Patent") (earlier patent family member) claims priority to and was a continuation of U.S. Patent App. Serial No. 11/646,692, filed December 27, 2006. During prosecution, inventor Paul Howard submitted a declaration under 37 C.F.R. § 1.131 declaring he "conceived of and completed the invention" of the '356 Patent "[p]rior to November 29, 2006." Ex-1029. All of the above prior art references predate this date as well.

Reference	Prior Art Dates	Status
U.S. Patent No. 8,417,248 ("Papaskellariou") (Ex-1005)	Priority: August 14, 2006 Filed: August 14, 2007 Published: February 14, 2008	§ 102(e)
U.S. Patent Application Publication No. 2007/0058595 ("Classon") (Ex-1006)	Priority: March 30, 2005 Filed: March 20, 2006 Published: March 15, 2007	§ 102(e)
U.S. Patent No. 7,817,605 ("Liu") (Ex-1007)	Priority: August 22, 2003 Filed: August 22, 2003 Published: February 24, 2005	§ 102(b) § 102(e)
U.S. Patent Application Publication No. 2008/0045260 ("Muharemovic") (Ex-1008)	Priority: August 15, 2006 Filed: August 15, 2007 Published: February 21, 2008	§ 102(e)
U.S. Patent No. 7,668,564 ("Onggosanusi") (Ex-1016)	Priority: June 20, 2005 Filed: June 20, 2006 Published: December 21, 2006	§ 102(a) § 102(e)

IV. '000 PATENT

A. Overview

The '000 Patent describes a closed loop method to "enable active feedback control between a base station and user equipment (UE)" where "the operation of a system designed for TDD, or unpaired operation, is expanded to operate in FDD, or paired, mode." Ex-1001, 2:25-29. The '000 Patent explains that Time Division Duplex (TDD) "uses the same radio channel for both uplink and downlink communications, and discriminates between signals by separating the transmissions in time." Ex-1001, 1:23-26. Further, such a TDD system "can be adjusted to operate

in Frequency Division Duplex (FDD) mode, where the uplink and downlink communications occur on different frequencies.” Ex-1001, 4:15-17.

The '000 Patent explains that TDD enables channel reciprocity that “gives equipment the ability to derive information about uplink channel conditions from downlink channel conditions based upon signals received by the user equipment (UE)” and that “[p]athloss is one example of channel information that can be obtained from channel reciprocity.” Ex-1001, 1:29-33. This is known as open-loop power control because there is no feedback back mechanism between the base station and (UE). Ex-1003, ¶¶48-49.

Further, the '000 Patent explains that channel reciprocity is not available when a system is operated in FDD mode but, “modifications may be made for the correct operation of uplink power control” by “defining an uplink physical control channel used for estimating the uplink channel conditions and a downlink channel used to feed back control information to the terminal” where “[t]hese channels may not need an associated data physical channel to be operational.” Ex-1001, 4:31-38. This is known as a closed-loop power control because there is a feedback mechanism between the base station and (UE). Ex-1003, ¶50.

The '000 Patent explains that “[w]hen pathloss reciprocity is not available, the combination of an uplink physical channel control signal with a downlink feedback channel may be used to keep the terminal informed of the condition of the uplink

channel,” where the “uplink physical control signal is referred to herein as an ‘Uplink Beacon’ (UL_Beacon).” Ex-1001, 4:45-51. Here, the UL_Beacon signal may be combined with a physical layer common control channel (PLCCH) to form a feedback system.” Ex-1001, 2:43-45.

Figure 2 shows an exemplary TD-CDMA uplink and downlink frame structure “modified to support FDD.” Ex-1001, 5:62-65. The uplink frame includes “a UL_Beacon control timeslot 216, an access control timeslot 218, and normal traffic carrying timeslots 214” and the downlink frame includes “a downlink beacon timeslot 206, an access control timeslot 208, and normal traffic carrying timeslots 210.” Ex-1001, 6:1-6.

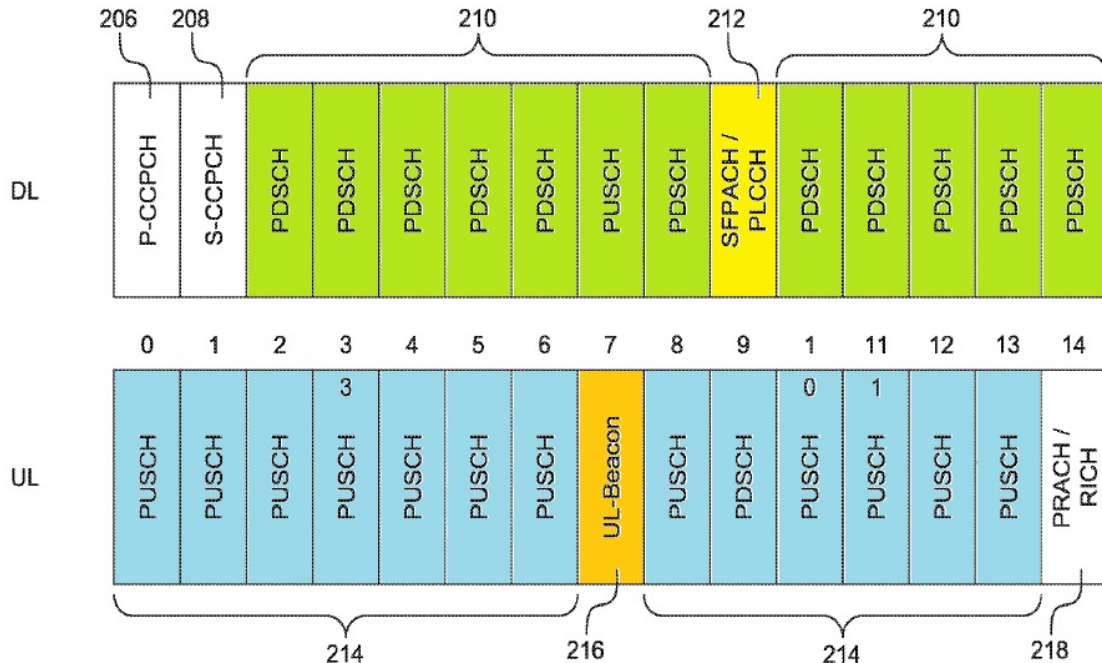


FIG. 2

Ex-1001, Fig. 2 (annotated).

The allocated regions for downlink data traffic (green) are called the “physical downlink shared channel,” “PDSCH 210.” Ex-1001, 6:1-3, 10:18-20. The allocated region for downlink control transmissions (yellow) is called the “downlink control channel” or “physical layer common control channel,” “PLCCH 212.” Ex-1001, 2:43-55, Abstract. The allocated regions for uplink data traffic (blue) are called the “physical uplink shared channel,” “PUSCH 214.” Ex-1001, 6:3-6, 9:61-63. The allocated region for uplink control transmissions (orange) is called the “uplink physical control channel,” “UL-Beacon 216.” Ex-1001, 6:3-6, 4:33-37.

In operation, the UE sends a UL-Beacon signal to the base station using the uplink physical control channel. The base station processes the UL-Beacon signal and provides feedback information to the UE using the downlink control channel. Ex-1001, 2:25-45, 2:49-55, 4:46-51. For example, the base station may determine a received power from the signal and, based on the received power, send power control information as feedback. Ex-1001, 5:5-13, 10:24-26. UEs additionally send data to the base station over the physical uplink shared channel, while the base station sends data to UEs over the physical downlink shared channel. Ex-1001, 10:17-20, 10:65-67.

B. Prosecution History

The application for the '000 Patent was filed on November 13, 2019, containing 24 claims. Throughout prosecution, the Examiner issued multiple rejections, citing grounds under 35 U.S.C. § 103, based on several prior art references.

C. Person of Ordinary Skill in the Art

The '000 Patent relates to an air interface between user equipment and base stations, where active feedback control is accomplished using uplink and downlink signals and channels. Ex-1001, Abstract, 2:15-29. A person of ordinary skill in the art (“POSITA”) relevant to this patent at the time of its invention would have had at least a bachelor’s degree in electrical engineering, computer engineering, or related field, with at least three to four years of experience in wireless communication technology, or a master’s degree in electrical engineering, computer engineering, or equivalent. Additional education could substitute for professional experience and vice versa. Ex-1003, ¶¶31-34.

V. CLAIM CONSTRUCTION

Claims should be construed “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b); *see Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Claim construction is only

required where necessary to resolve a dispute. *See, e.g., Toyota Motor Corp. v. Cellport Sys., Inc.*, IPR2015-00633, Paper 11 at 16 (P.T.A.B. Aug. 14, 2015) (citing *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011)).

In addressing claim construction of the term “time interval” in a related IPR (IPR2022-01130)³, the Board stated that “we interpret ‘time interval’ to mean a ‘timeslot’ and the processor sends a signal over an uplink physical control channel ‘in a timeslot that is not sending information over the physical uplink shared channel, e.g., a timeslot separated from timeslots used to send data.’” Ex-1013, pp.12, 17.

The Board reiterated its position in the Final Written Decision. Ex-1014, p.20 (“we interpret this claim language in light of the ’356 patent specification to require a dedicated timeslot for a UL_Beacon”). Petitioners adopt the Board’s construction of “time interval” to be a timeslot and reserves the right to further address this position should trial be instituted. Additionally, Petitioners reserve the right to address construction of any terms raised at trial, or in the related district court actions.

³ IPR2022-01130 determined all challenged claims to be unpatentable. *See* Ex-1014.

VI. TECHNICAL BACKGROUND

A. 3GPP and LTE development

The Third Generation Partnership Project (3GPP) is the global standards development body responsible for the evolution of mobile communication technologies including GSM, UMTS, and LTE. The work of 3GPP is advanced through a formal process of technical contributions, where companies and organizations submit temporary technical documents prior to or during a meeting. At the meetings, contributions are presented, discussed, and modified. Ex-1003, ¶¶38-39.

B. Physical Layer

Orthogonal Frequency Division Multiplexing (OFDM) is the fundamental modulation technique adopted in LTE. OFDM divides the available spectrum into a large number of narrowband, closely spaced subcarriers, where each subcarrier carries a lower rate data stream. The transmission of multiple parallel low-rate streams enables high spectral efficiency and robustness against multipath fading. Each OFDM symbol has a fixed duration determined by the subcarrier spacing, and a cyclic prefix is added to absorb multipath delay spread. Ex-1003, ¶40.

Orthogonal Frequency Division Multiple Access (OFDMA) extends OFDM into a multi-user access scheme, where simultaneous transmission to and from multiple users may occur. Ex-1003, ¶41.

The time-frequency structure of OFDM symbols is organized into frames and slots. In LTE, a radio frame has a duration of ten milliseconds and is divided into ten subframes of one millisecond each. Each subframe is further divided into slots, and each slot typically contains seven OFDM. Ex-1003, ¶¶41-42.

The figure below illustrates the LTE OFDM frame structure. Each slot consists of a fixed number of OFDM symbols, and the frequency axis is divided into subcarriers that are grouped into resource blocks. Ex-1003, ¶¶43-44.

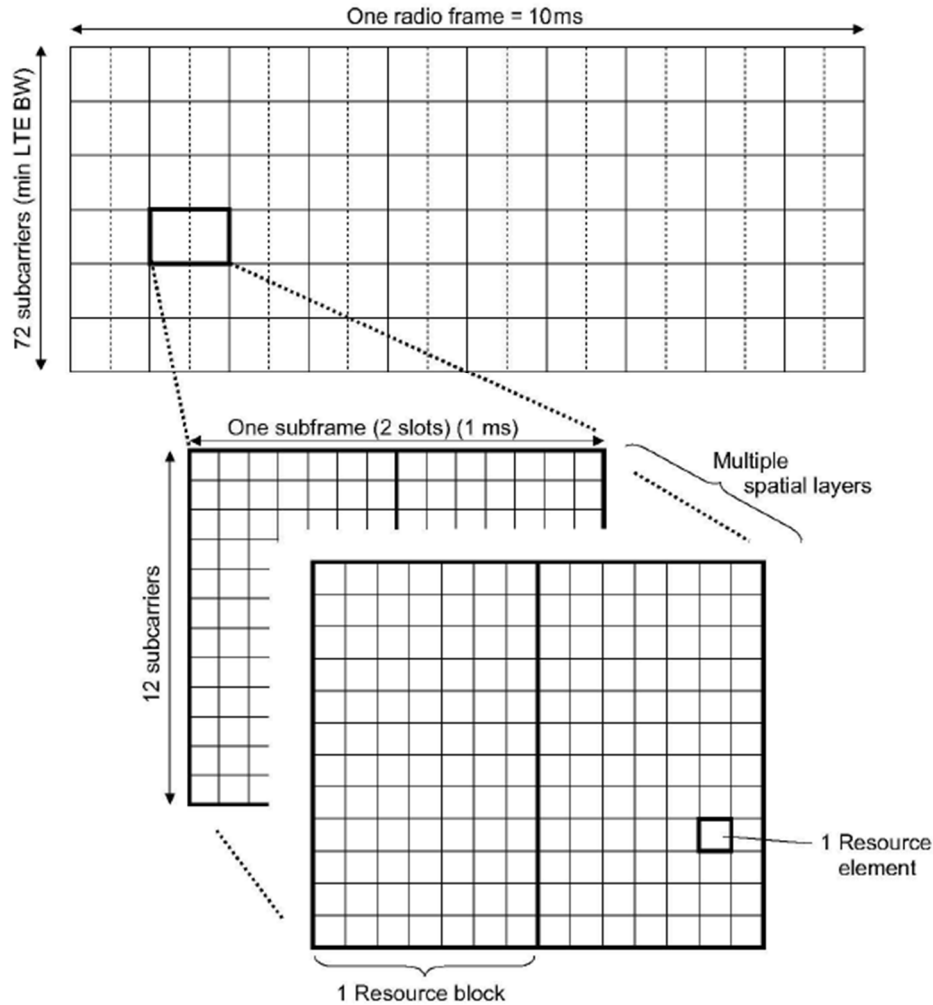


Figure 6.1 Basic time-frequency resource structure of LTE (normal cyclic prefix case).

Ex-1015, p.136.

C. Channel Structure

The mapping of logical data flows onto the physical layers in 3GPP systems is defined by a set of physical channels. In the downlink, the Physical Downlink Shared Channel (PDSCH) carries user data and is mapped onto the assigned OFDM symbols and subcarriers. The Physical Downlink Control Channel (PDCCH)

conveys scheduling information and control messages that inform user equipment of its resource allocations. In the uplink, the Physical Uplink Shared Channel (PUSCH) carries user data using either SC-FDMA or OFDMA. The Physical Uplink Control Channel (PUCCH) carries uplink control signaling such as acknowledgments, scheduling requests, or channel state feedback. Reference signals such as the Demodulation Reference Signal (DMRS), Channel State Information Reference Signal (CSI-RS), and Sounding Reference Signal (SRS) are embedded in the time-frequency grid to support channel estimation, link adaptation, and beamforming. Ex-1003, ¶¶45-46.

D. Reference Signals

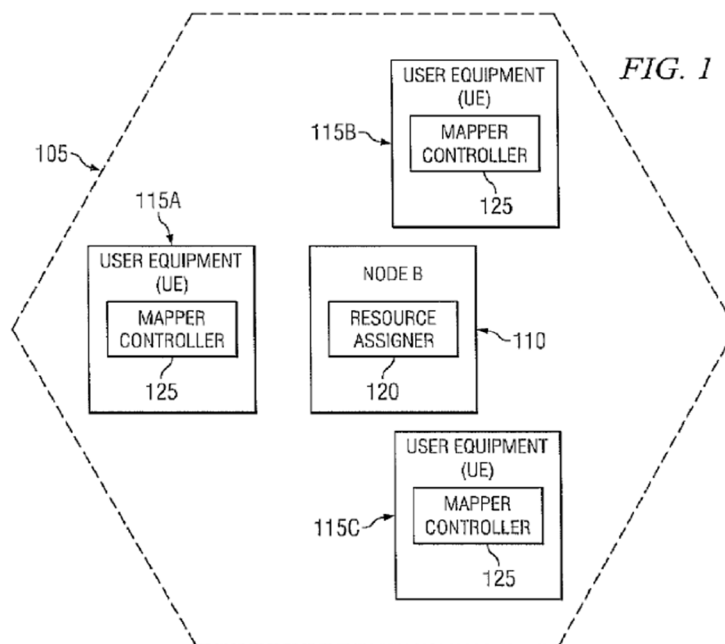
The reference signals mentioned above are implemented using the Constant Amplitude Zero Auto Correlation (CAZAC) property derived from Zadoff-Chu sequences. One of the useful properties of CAZAC sequences is the ability to generate many sequences from one initial sequence using cyclic shifting, where the resulting set of sequences all exhibit low cross-correlation (correlation between different CAZAC sequences). In other words, the transmitted sequences are orthogonal. This allows multiple devices to simultaneously transmit these sequences using the same frequency resources with minimal interference. Ex-1003, ¶47.

VII. PRIOR ART

A. Papasakellariou (U.S. Patent No. 8,417,248)

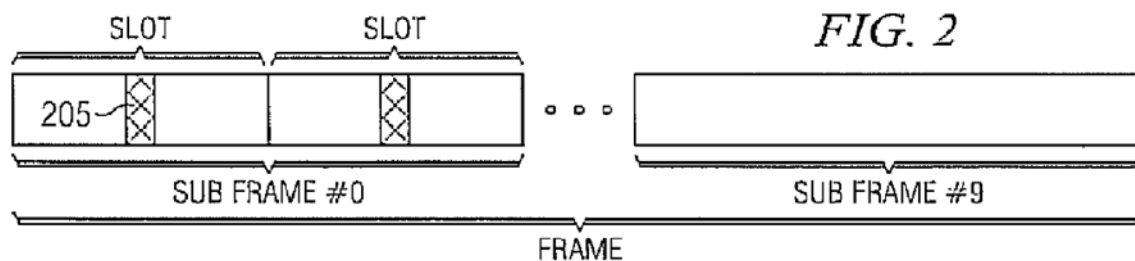
Papasakellariou discloses a method and apparatus for scheduling uplink transmissions in cellular communication systems. Papasakellariou explains “measuring channel conditions for a plurality of equipment devices at a base transceiver station of a wireless communication system, dividing an operating bandwidth of the base transceiver station into two or more non-overlapping portions, and instructing a first of the plurality of user equipment devices to transmit a sounding reference signal in a first non-overlapping portion during a sounding reference signal transmission interval.” Ex-1005, Abstract.

Figure 1 shows a wireless communication system having a base transceiver station (Node B) and user equipment devices (UEs).



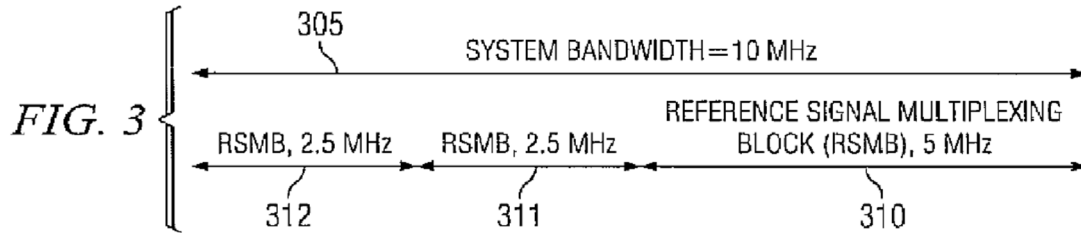
Ex-1005, Fig. 1. Papasakellariou explains the invention may be advantageously implemented using an orthogonal frequency division multiplexing (OFDM)-based system. Ex-1005, 2:48-65.

Figure 2 shows “example transmission frame format that may be transmitted by any or all of the example wireless base stations and/or the example user equipment of FIG. 1.” Ex-1005, 2:21-23.



Ex-1005, Fig. 2. Here, time is partitioned into “units of system frames (each 10 milliseconds (msec) in duration), which are further divided into ten sub-frames (each 1 msec in duration),” and “sub-frames are further divided into two slots (each 0.5 msec in duration).” Ex-1005, 5:6-11.

While Figure 2 shows a time-based aspect to the Papasakellariou frame structure, Figure 3 shows a frequency or bandwidth aspect to the frame structure. For example, as shown in Figure 3, Papasakellariou explains that the Node B “partitions the operating bandwidth of the example wireless cell 105 into two or more non-overlapping portions, referred to herein as reference signal multiplexing blocks (RSMBs).” Ex-1005, 5:46-49.



Ex-1005, Fig. 3. Here, the total system bandwidth is partitioned into a 5 MHz RSMB and two 2.5 MHz RSMBs. Papasakellariou further explains the Node B assigns each of the UE devices to a particular RSMB based on their associated CQI estimate. Ex-1005, 6:30-36.

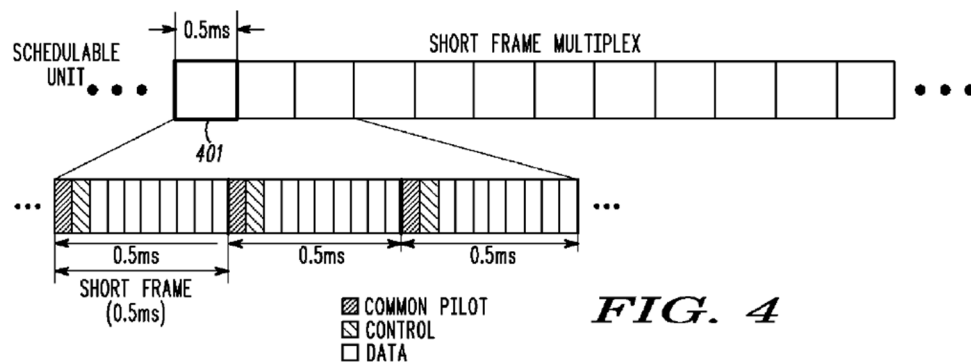
Figures 2 and 3 show how system resources are defined, where “resources can include frequencies, time-slots, signature codes, channels, reference signals, etc.” Ex-1005, 1:37-39; Ex-1003, ¶61.

To allocate resources, the Node B measures and/or collects SINR data for its associated UE devices. The Node B assigns each UE to a RSMB and for each sounding reference signal transmission interval determines whether each UE is to transmit an SRS and if so, which SRS is to be transmitted and in which transmission interval (symbol) of the uplink sub-frame and in which RSMB(s). The Node B then generates and sends downlink control signaling to convey the SRS, RSMB and SRS transmission interval assignments to the UE devices. Ex-1005, 12:4-17; Ex-1003, ¶62.

B. Classon (U.S. Patent Application Publication No. 2007/0058595)

Classon discloses a radio communication frame structure divided into a plurality of subframes, where subframes of different durations may be used. Ex-1006, Abstract. Classon explains that “no single frame duration is best for different traffic types requiring different quality of service (QoS) characteristics or offering differing packet sizes,” which “is especially true when the control channel and pilot over head in a frame is considered.” Ex-1006, [0004].

Classon explains “radio frames are divided into a plurality of subframes,” and “[d]ata is transmitted over the radio frames within a plurality of subframes, and having a frame duration selected from two or more possible frame durations.” Ex-1006, [0024]. Classon provides two exemplary frames having different durations in Figures 4 [a short frame] and 5 [a long frame], where the system is “a next generation Orthogonal Frequency Division Multiplexed (OFDM) or multicarrier based architecture, such as OFDM” where “data transmission may be a downlink transmission or an uplink transmission.” Ex-1006, [0031].



Ex-1006, Fig. 4.

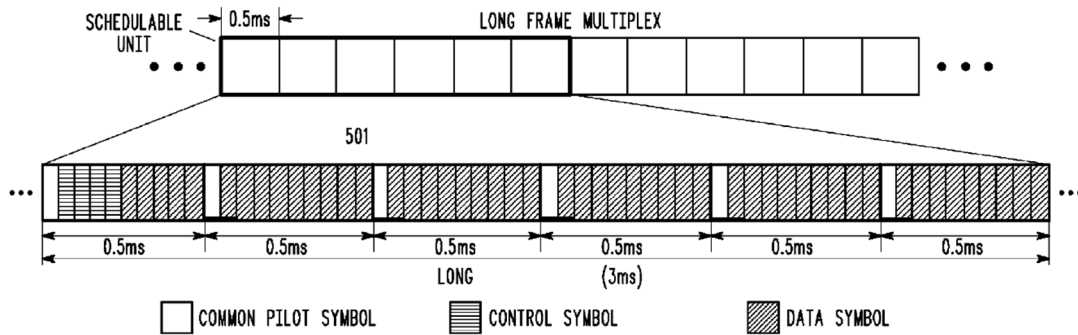


FIG. 5

Ex-1006, Fig. 5.

Further, “when a user is to be scheduled on a frame, a resource allocation message corresponding to a frame will provide resources (e.g., for an OFDM system a number of modulation symbols each of one subcarrier on one OFDM symbol) in the frame for transmission.” Ex-1006, [0037].

Classon further explains the example frames above as follows.

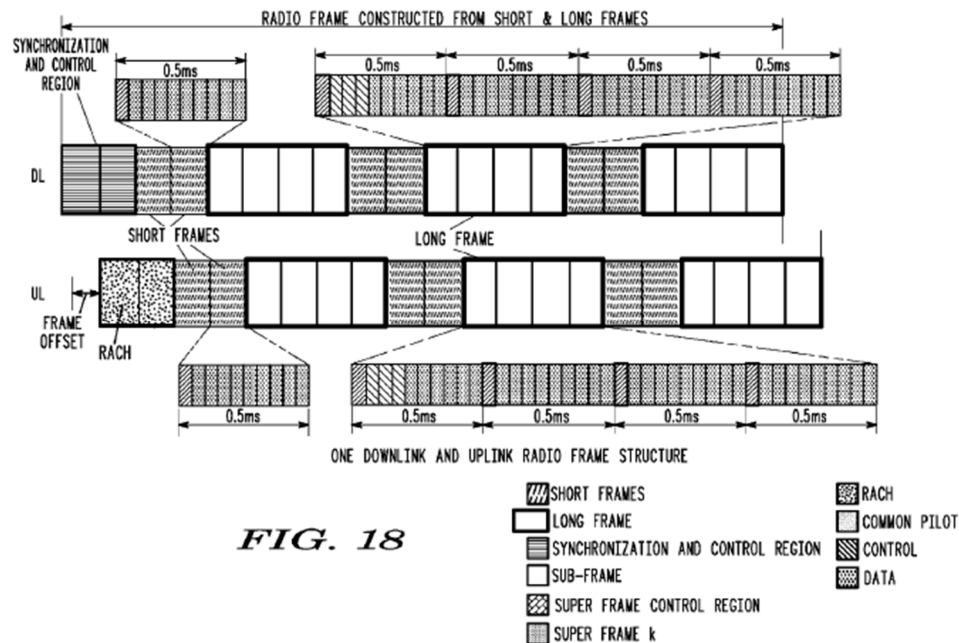
In the example of FIG. 4 and FIG. 5, a subframe is of duration 0.5 ms and 10 symbols, $n_s=1$ for the short frame 401 while $n=6$ (3 ms) for the long frame 501, although other values may be used. ... As an example, a common pilot or common reference symbol or common reference signal is time division multiplexed (TDM) onto the first symbol of each subframe, and control symbols are TDM onto the first symbols of each frame (other forms of multiplexing such as FDM, CDM, and combinations may also be used).

Ex-1006, [0044].

Classon explains the noted frames may have an associated control structure where “[r]esource allocation (RA) control is typically provided for each frame and

its respective frame duration.” Ex-1006, [0088]. Further, “[t]he control channel is preferably TDM (e.g., one or more TDM symbols), and located at or near the start of the frame.” Ex-1006, [0088].

Classon discloses “[t]he radio frame configurations shown may be for either the uplink or the downlink of an FDD system.” Ex-1006, [0097].



Ex-1006, Fig. 18.

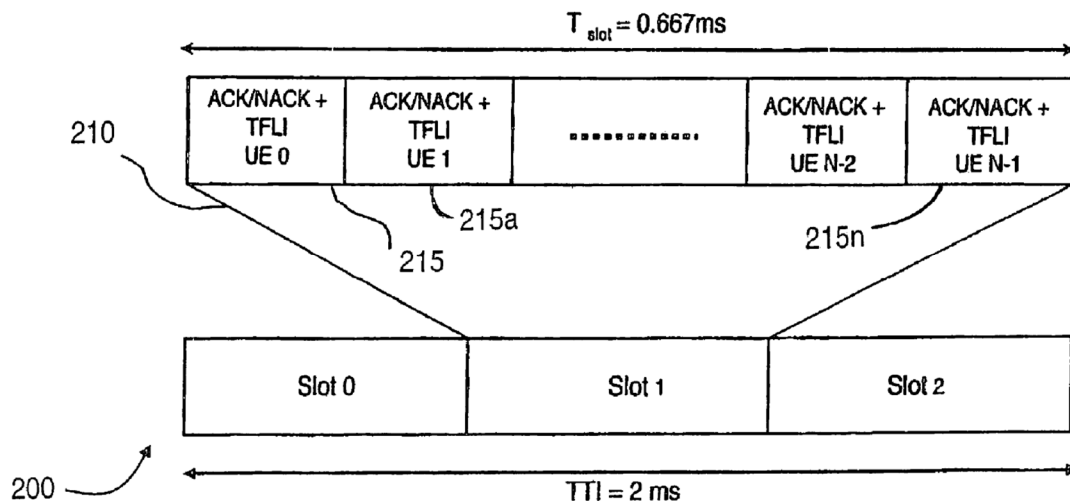
C. Liu (U.S. Patent No. 7,817,605)

Liu discloses a method of transmitting downlink control signals for uplink transmission of packet data using a shared control channel carrying control signal data. The shared control channel includes fields identifiable by, or specified for, different users, so that each field includes control signal data for a specific user. A

particular user decodes a corresponding field of the shared control channel to interpret the control signal data. Ex-1007, Abstract.

Liu explains that this “‘shared’ control channel may be shared by up to N users at the same time instant,” and “[t]he shared control channel may hereafter be referred to as an Enhanced Uplink Rate Controlled Signaling Channel (EU-RCSCH).” Ex-1007, 3:33-36, 58-60. Liu further discloses the “EU-RCSCH is a physical channel.” Ex-1007, 3:66.

Liu explains the EU-RCSCH “may be embodied as a sub-frame, each sub-frame including a plurality of slots, each slot including one of [or] more fields.” Ex-1007, 4:14-16. Figure 2 discloses an exemplary structure of an EU-RCSCH sub-frame, with slots and fields. Each field may include first and second indicators.



Ex-1007, Fig. 2.

Liu further explains the sub-frame components as follows.

The first indicator may be embodied as acknowledgment (ACK) and/or negative acknowledgment (NACK) data indicating whether a previous transmitted packet was received by the Node B. The second indicator may be referred to as a Transport Format Limit Indicator (TFLI). A TFLI represents an upper bound or limit for a transmit rate, and may inform the UE whether or not to adjust its transmit rate, and in which direction (raise transmit power, lower transmit power, maintain transmit power).

Ex-1007, 4:17-28.

Liu further explains the UE specific bit allocations carried on the EU-RCSCH may be 1 bit for the ACK/NACK indicator and 1 bit for the TFLI indicator. Ex-1007, 8:32-37. However, “the bit allocations could be N-bit values, N representing a positive integer greater than 1,” and “bit allocations for the ACK/NACK and TFLI fields could be different positive integers.” Ex-1007, 9:36-40.

D. Motivation to Combine Papasakellariou, Classon, and Liu

A POSITA would have been motivated to combine the teachings of Papasakellariou and Classon because both are directly applicable to OFDM-based cellular communications systems having a base station and user equipment. Ex-1003, ¶75.

Papasakellariou, for example, discloses an “example transmission frame format that may be transmitted by any or all of the example wireless base stations and/or the example user equipment of FIG. 1” and the “example methods and apparatus have particular applicability in orthogonal frequency division

multiplexing (OFDM)-based wireless communication systems.” Ex-1005, 2:24-26, 2:51-54.

Similarly, Classon discloses “[c]ommunication system 100 comprises a plurality of cells 105 (only one shown) each having a base transceiver station (BTS, or base station) 104 in communication with a plurality of remote, or mobile units 101-103,” and “[i]n the preferred embodiment of the present invention, communication system 100 utilizes a next generation Orthogonal Frequency Division Multiplexed (OFDM) or multicarrier based architecture.” Ex-1006, [0031].

Additionally, both Papasakellariou and Classon are directed to the development of the 3GPP LTE development effort. For example, Papasakellariou discloses system components that may be “implemented ... in accordance with one or more past, present and/or future wired and/or wireless communication standards and/or specifications, such as the Evolved Universal Terrestrial Radio Access (EUTRA) specification currently being defined by Third Generation Partnership Project (3GPP).” Ex-1005, 3:28-37. Classon discloses “key requirements for wireless broad band system development, such as in the 3rd generation partnership project (3GPP) Long Term Evolution (LTE),” and “[s]uch systems include enhanced Evolved Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access Network (UTRAN) (also known as EUTRA and EUTRAN) within 3GPP.” Ex-1006, [0003].

Indeed, many of the Papasakellariou and Classon inventors were active delegates to 3GPP meetings. *See* Ex-1021-Ex-2026 (3GPP meeting minutes showing inventors present and submitting technical contributions at 3GPP meetings). Because the references address improvements within the same 3GPP technology space, a POSITA would have viewed them as complementary contributions. The 3GPP standardization process itself provides strong motivation to combine as delegates routinely combined insights from multiple references in order to propose, evaluate, and optimize candidate solutions for adoption into the 3GPP specifications. *See supra* § VI.A. Ex-1003, ¶79.

Further, Liu discloses a “method of transmitting control signals for uplink transmission of packet data, a control channel carrying control signal data that is shared by a plurality of users is transmitted in the downlink to the users,” where “[t]he specified user decodes a corresponding field of the shared control channel to interpret the control signal data, and may transmit packet data in the uplink in accordance with the decoded control signal data.” Ex-1007, Abstract.

A POSITA would thus have been motivated to implement the uplink scheduling methodology of Papasakellariou with the uplink/downlink physical channel structure of Classon and the user equipment decoding of fields of a shared control channel to interpret control signal data as disclosed by Liu. Ex-1003, ¶81.

Thus, combining Papasakellariou and Classon with Liu would have been a predictable, routine step aimed at developing an uplink power control methodology applicable to the developing 3GPP LTE cellular system and would have a reasonable expectation of success. The combination would not require extensive experimentation nor undue burden but rather would reflect the normal course of development in line with 3GPP's publicly available working documents and collaborative development process. Ex-1003, ¶82.

E. Muharemovic (U.S. Patent Application Publication No. 2008/0045260)

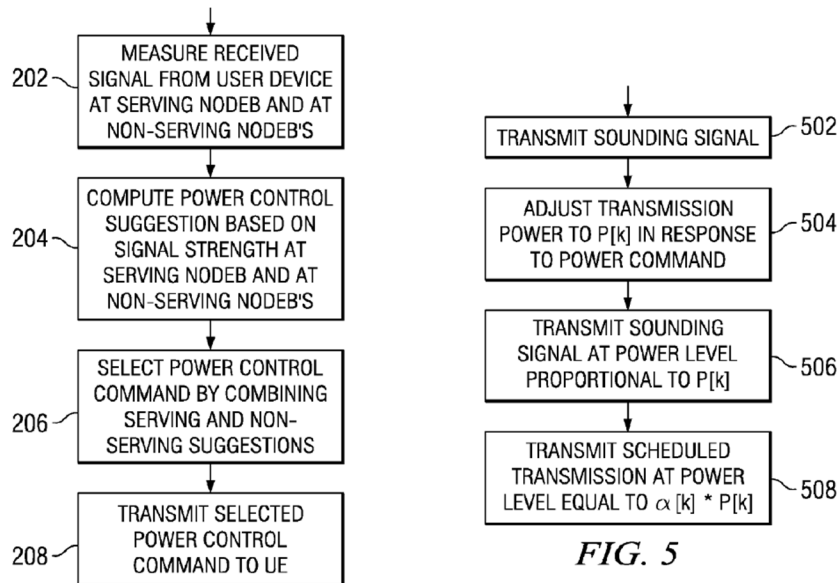
Muharemovic discloses a communication system with sounding reference signals (SRSs) and data transmissions in sub-frames. A sounding reference signal is transmitted from a user equipment device to a base station with a power level that is either open loop controlled or closed loop controlled. The base station informs the UE of scheduled channels, as well as a data transmit power offset parameter, where the data transmit power level is decided according to the sounding reference signal transmit power, the allocated channels, and the data transmit power offset. Ex-1008, Abstract.

Muharemovic describes the system in Figures 2 (base station) and 5 (UE, where Figure 5 is described as Figure 4 in the specification). In operation, a UE transmits an SRS (502/402) that is received and processed (204, 206) by both serving

and non-serving cell sites (base stations) of a cellular network. Ex-1008, [0054].

The SRS processing is based on the received signal strength (202) of the SRS. After processing, the serving cell site transmits a power control command (208) to the UE.

Ex-1008, [0039]-[0041].



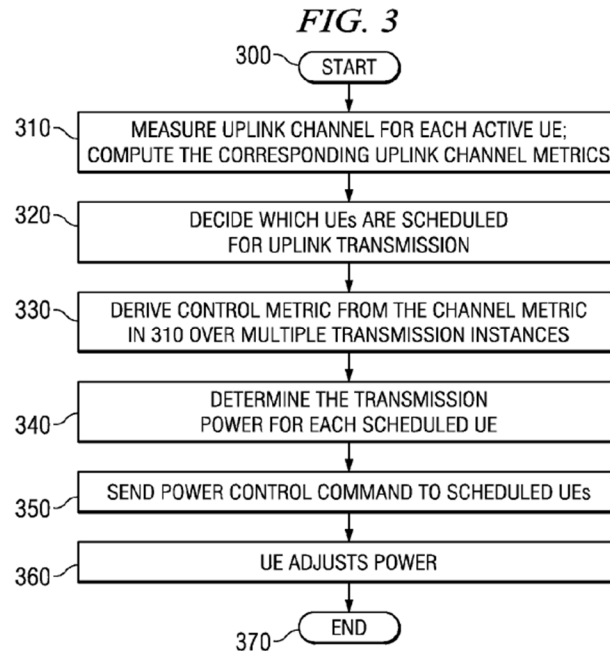
Ex-1008, Fig. 2, Fig. 5.

The UE adjusts SRS power per the received power control command (504/404). Ex-1008, [0054].

F. Onggosanusi (U.S. Patent No. 7,668,564)

Onggosanusi discloses a method of using a network entity and user equipment for slow uplink power control in a wireless communication system. Ex-1016, Abstract. As shown in Figure 3 (310), a “network entity, Node B or a base station for example, measures the uplink channel for each of the active UEs.” Ex-1016,

5:25-26. Next (320), the “the base station derives and uses a particular metric to decide which UEs are scheduled for uplink transmission,” where “[e]xamples of such metric is the channel quality indicator (CQI) or SINR or channel energy or simply the instantaneous received power.” Ex-1016, 5:29-33.



Ex-1016, Fig. 3.

Next (340), “the base station determines the appropriate UE transmit power for the scheduled UEs using one or more criteria.” Ex-1016, 5:51-53. Then (350), the base station “sends a command to each of the scheduled UEs to increase, decrease, or maintain its transmit power.” Ex-1016, 6:37-39. Finally (360), “depending on the slow power control command from the base station, the UE adjusts its transmit power accordingly.” Ex-1016, 7:5-7.

G. Motivation to Combine Muharemovic, Onggosanusi, and Classon

A POSITA would have been motivated to combine the teachings of Muharemovic and Onggosanusi because both address the issue of uplink power control in OFDM-based cellular communications systems having a base station and user equipment. Ex-1003, ¶88.

Muharemovic, for example, discloses “[t]his invention generally relates to cellular communication systems, and in particular to controlling uplink power.” Ex-1008, [0003]. Further, “slow power control is more critical for orthogonal multiple access schemes.” Ex-1008, [0015]. Further still, “FIG. 1 is a representation of two cells in a cellular communication network that includes an embodiment of closed loop power control.” Ex-1008, [0018].

Similarly, Onggosanusi discloses, “[t]he invention relates generally to communication systems.” Ex-1016, 1:13-15. Further, “[t]he network infrastructure 200 generates slow power control commands ... and transmits the slow power control commands to the user equipment 202 over a downlink control channel 206,” where “[t]he slow power control commands may be associated with an inner loop of a closed-loop power control protocol.” Ex-1016, 4:38-45.

A POSITA would have been motivated to combine the teachings of Muharemovic and Onggosanusi because both are rooted in the well-known 3GPP standardization efforts. Both Muharemovic and Onggosanusi were oriented to the

development of the LTE/E-UTRAN 3GPP cellular systems. For example, Muharemovic discloses “OFDMA is currently a working assumption in 3GPP Long Term Evolution downlink”, and “[t]his is the case for the next generation UMTS enhanced-UTRA (E-UTRA) system—which employs SC-FDMA.” Ex-1008, [0005], [0015]. While Onggosanusi discloses “[t]his is the case for the next generation UMTS enhanced-UTRA (E-UTRA) system which employs SC-FDMA” and “[a]t the same time, different network architecture is envisioned for the next generation systems such as the UMTS E-UTRA which is a full-IP based network.” Ex-1016, 2:9-11, 3:1-7; Ex-1003, ¶91.

Indeed, many of the Muharemovic and Onggosanusi inventors were active delegates to 3GPP meetings. *See* Ex-1021-Ex-2026 (3GPP meeting minutes showing inventors present and submitting technical contributions at 3GPP meetings). Because the references address improvements within the same 3GPP-driven technology space, a POSITA would have viewed them as complementary contributions. The 3GPP standardization process itself provides strong motivation to combine as delegates routinely combined insights from multiple references in order to propose, evaluate, and optimize candidate solutions for adoption into the 3GPP specifications. *See supra* § VI.A. Ex-1003, ¶92.

Finally, a POSITA would have been motivated to combine the teachings of Muharemovic and Onggosanusi with Classon because Classon, like Muharemovic

and Onggosanusi, was also oriented to the development of the LTE/E-UTRAN 3GPP cellular systems. For example, “key requirements for wireless broad band system development, such as in the 3rd generation partnership project (3GPP) Long Term Evolution (LTE),” and “[s]uch systems include enhanced Evolved Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access Network (UTRAN) (also known as EUTRA and EUTRAN) within 3GPP.” Ex-1006, [0003]; Ex-1003, ¶93.

Further, Classon discloses an implementation of an uplink and downlink physical channel structure compatible with the closed loop power control methods of Muharemovic and Onggosanusi. Ex-1006, Fig. 5, Fig. 18; Ex-1003, ¶94.

Thus, combining Muharemovic and Onggosanusi with Classon would have been a predictable, routine step aimed at developing an uplink power control methodology applicable to the developing 3GPP LTE cellular system and would have a reasonable expectation of success. The combination would not require extensive experimentation nor undue burden but rather would reflect the normal course of development in line with 3GPP’s publicly available working documents and collaborative development process. Ex-1003, ¶95.

VIII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-24 are obvious over Papasakellariou in view of Classon and further in view of Liu

1. '000 Patent Independent Claims

The independent claims of the '000 Patent recite substantially overlapping subject matter related to transmissions/receptions between user equipment and a network device. Petitioners address the independent claims together.

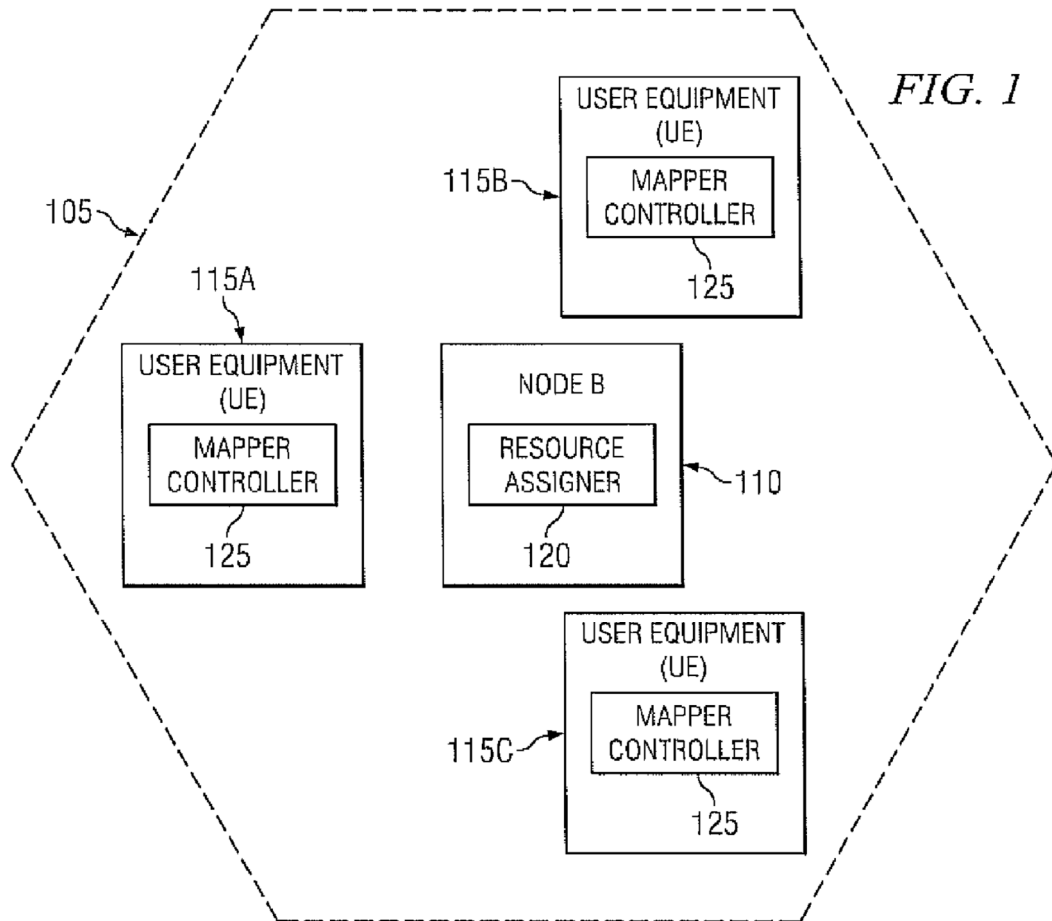
a. 1[pre] A user equipment (UE) comprising:

7[pre] A network device comprising:

**13[pre] A method performed by user equipment (UE),
the method comprising:**

**19[pre] A method performed by a network device, the
method comprising:**

To the extent the preambles are limiting, Papasakellariou discloses these preambles. For example, Papasakellariou describes, in Figure 1, an example wireless communication system where “a plurality of cells could be arranged in a pattern and/or grid with abutting and/or overlapping coverage areas such that user endpoint (UE) devices located in, and/or moving through and/or within an area communicatively covered by one or more of the plurality of cells can communicate with at least one wireless base station.” Ex-1005, 3:7-12.



Ex-1001, Fig. 1.

The Papasakellariou wireless base station (e.g., a Node B) is a network device and the Papasakellariou UE device is user equipment (UE). Further, Papasakellariou discloses “[m]ethods and apparatus to schedule uplink transmissions in wireless communication systems” involving a “base transceiver station” and “user equipment devices.” Ex-1005, Abstract. Thus, Papasakellariou discloses these preambles. Ex-1003, ¶¶97-99.

- b. **1[a]/13[a] [a receiver and a processor are configured to receive]/[receiving] resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;**

7[a]/19[a] [a transmitter and a processor are configured to transmit]/[transmitting] resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

Papasakellariou and Classon disclose these limitations. Ex-1003, ¶100.

- i. **a receiver/transmitter and a processor configured to receive/transmit**

Classon discloses, in Figure 2, an implementation of a base station and mobile station processors, transmitters and receivers.

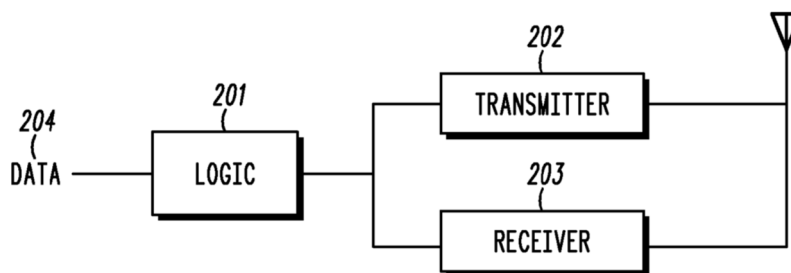


FIG. 2
200

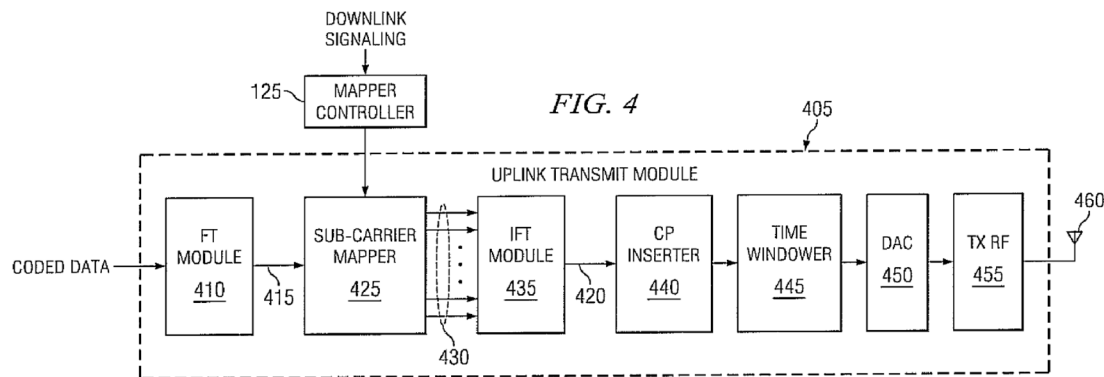
Ex-1006, Fig. 2.

FIG. 2 is a block diagram of circuitry 200 for base station 104 or mobile station 101-103 to perform uplink and downlink transmission. As shown, circuitry 200 comprises logic circuitry 201, transmit circuitry 202, and receive circuitry 203. Logic circuitry 200 preferably comprises a microprocessor controller,

such as, but not limited to a Freescale PowerPC microprocessor. Transmit and receive circuitry 202-203 are common circuitry known in the art for communication utilizing a well known network protocols, and serve as means for transmitting and receiving messages. For example, transmitter 202 and receiver 203 are preferably well known transmitters and receivers that utilize a 3GPP network protocol.

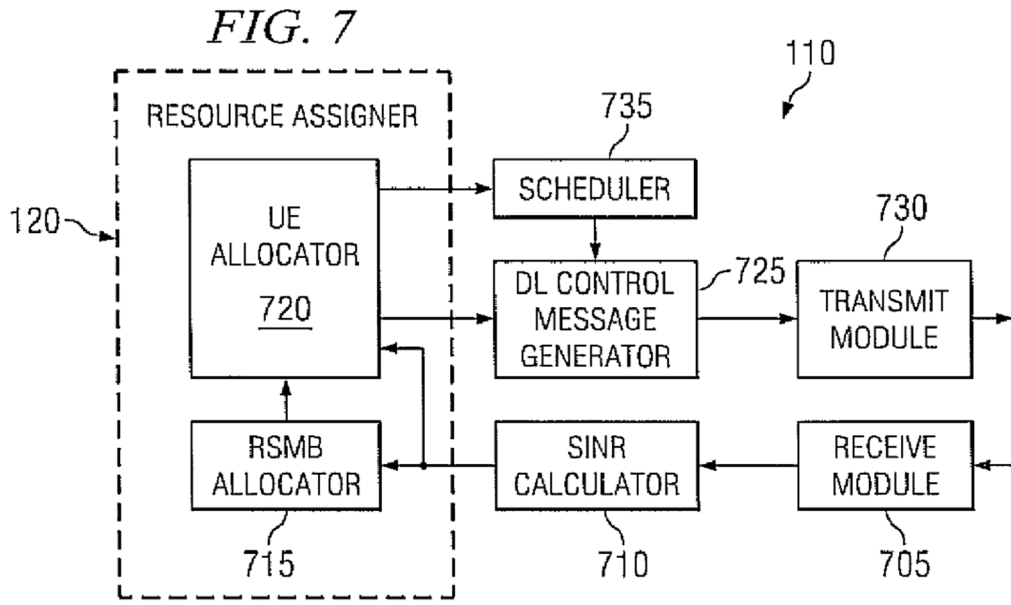
Ex-1006, [0041].

Papasakellariou discloses a UE device transmitter in Figure 4, where “FIG. 4 illustrates an example manner of implementing an uplink transmit module 405 for any or all of the example UE devices.” Ex-1005, 8:24-26.



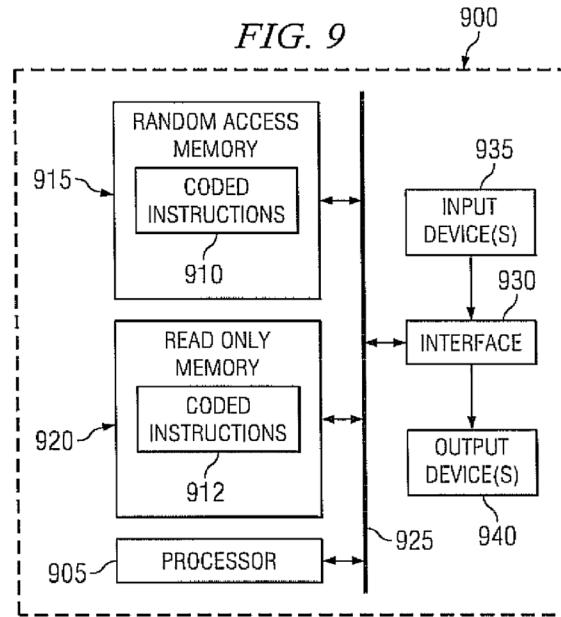
Ex-1005, Fig. 4.

Further, Papasakellariou Figure 7 discloses an implementation of an exemplary Node B with a receiver and transmitter.



Ex-1005, Fig. 7; *see also id.*, 9:48-50 (“FIG. 7 illustrates an example manner of implementing the example resource assigner 120 and/or, more generally, the example Node B 110 of FIG. 1.”).

Papasakellariou discloses “FIG. 9 is a schematic diagram of an example processor platform 900 that may be used and/or programmed to implement any portion(s) and/or all of the example resource assigners 120 and/or the example Node Bs 110 and/or the example mapper controllers 125 of FIGS. 1, 4 and/or 7,” where the “processor platform 900 can be implemented by one or more processors, processor cores, microcontrollers, DSPs, DSP cores, ARM processors, ARM cores, etc.” Ex-1005, 12:18-25.



Ex-1005, Fig. 9.

A POSITA would have understood the Classon and Papasakellariou implementations of base stations, mobile stations, UE devices, and Node Bs disclose a UE processor/receiver/transmitter and a network device (Node B) processor/receiver/transmitter configured to receive/transmit. Ex-1003, ¶105.

ii. receiving/transmitting resource allocation information associated with an uplink physical signal

Papasakellariou discloses that the base station (Node B) provides instructions, through downlink signaling, on where (which RSMB(s)), when (which transmission interval (symbol)) and how (SRS parameters) the UE should transmit the SRS for channel sounding.

The example Node B 110 of FIG. 1 **instructs the UE devices 115A-C through downlink control signaling** (through the

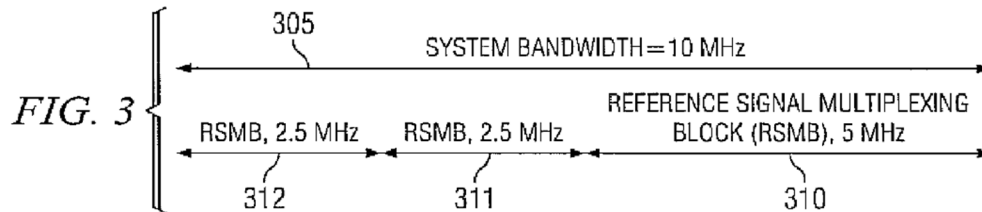
physical and/or media access control (MAC) layers, also referred to as L1/L2 control, and/or through higher layers) **when to transmit, in which RSMB(s) an SRS transmission should occur, and which SRS (out of a number of available SRS)** the UE should use for channel probing. The assignment of the above SRS transmission parameters can be such that it achieves orthogonal SRS multiplexing and/or reduces collisions among assigned SRSs in either RSMB.

Ex-1005, 7:28-37 (emphasis added)⁴, *see also id.*, 7:62-8:7 (“a UE device 115A-C having an uplink transmission in an RSMB, may **be instructed to transmit** a SRS”); *id.*, 8:26-34 (“the example mapper controller 125 **receives instructions** (e.g., from the example Node B 110 and/or the example resource assigner 120 via downlink control signaling) regarding whether, when and/or where to transmit reference and/or data signals”); *id.*, 12:11-17 (“generates downlink control signaling **to convey** the SRS, RSMB and SRS transmission interval assignments to the UE devices (block 835) ... transmit module 730 **sends the downlink control signaling to the UE devices**”).

A POSITA would have recognized the instructions or downlink control signaling of the assigned RSMB and SRS parameters sent by the Node B is resource allocation information associated with an uplink physical signal that is received by the UE. An assigned RSMB or set of RSMBs is resource allocation information because an RSMB defines a particular scheduled bandwidth. For example, as shown

⁴ Hereinafter emphasis and highlighting have been added unless otherwise noted.

in Figure 3, total system bandwidth may be split into RSMBs having 5 MHz (310) and 2.5 MHz (311 and 312). Ex-1003, ¶ 107.



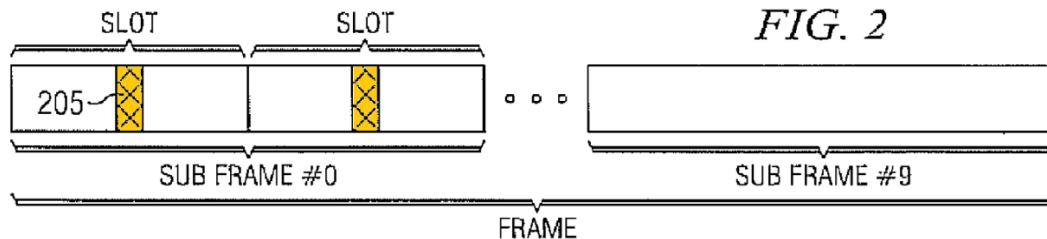
Ex-1005, Fig. 3.

Further, a POSITA would have recognized an SRS is an uplink physical signal because the SRS is transmitted from the UE to the Node B. Thus, Papasakellariou discloses that a Node B transmits resource allocation information associated with an uplink physical signal and a UE receives resource allocation information associated with an uplink physical signal. Ex-1003, ¶108.

iii. wherein the uplink physical signal and a physical uplink shared channel have different resources

For example, in Figure 2, Papasakellariou discloses an example transmission frame format that may be transmitted by either a base station or a user equipment (UE). Ex-1005, 2:24-26 (“FIG. 2 illustrates an example transmission frame format that may be transmitted by any or all of the example wireless base stations and/or the example user equipment of FIG. 1”).

Further, Papasakellariou explains a 10-millisecond system frame is partitioned into 10 sub-frames, each having a 1 millisecond duration. Each sub-frame is further divided into 2 slots of 0.5 milliseconds each. Ex-1001, 5:5-12.



Ex-1001, Fig. 2 (annotated). Papasakellariou explains each slot comprises seven SC-FDMA symbols and the middle symbol (205, orange) of each slot is used to transmit a reference signal. The other six symbols of each slot are reserved for uplink data and possibly control transmission, where one of the six symbols may be reserved for transmission of an SRS.

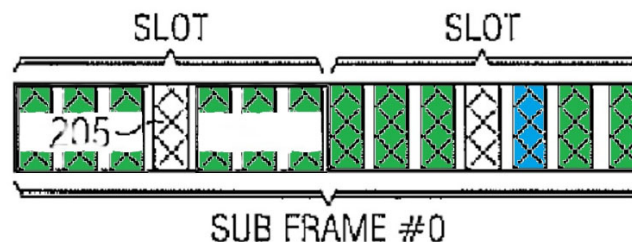
Each slot comprises one or more SC-FDMA symbols; for example, a slot may comprise of seven SC-FDMA symbols (not shown). In the illustrated example of FIG.2, one reference signal (RS) 205 is transmitted during the middle symbol of each slot. The remainder of each slot is divided into six additional **time intervals (symbols)** that are reserved for uplink data and possibly control transmission. **One of these six time intervals per slot can be assigned to sounding RS transmissions**, with some further restrictions being possible.

Ex-1001, 5:11-22.

A POSITA would have understood that the time intervals (symbols) that are reserved for uplink data transmission are a physical uplink shared channel assigned to a particular resource. Ex-1003, ¶112.

Further, “the UE allocator also determines which SRS is to be transmitted and in which transmission interval (symbol) of the uplink sub-frame.” Ex-1005, 12:7-10. A POSITA would have understood a particular symbol time interval assigned for an SRS transmission is a particular resource. Ex-1003, ¶113.

In the context of an uplink frame format, Figure 2 thus shows that the resources used for the SRS (the uplink physical signal) are different from the resources used for uplink data (the physical uplink shared channel) because the SRS transmission occurs in a particular symbol time interval different from the symbol time intervals used for uplink data. For example, as shown in the annotated Figure 2 below, the rightmost slot includes a scheduled SRS transmission in the fifth symbol time interval (blue), while symbol time intervals 1, 2, 3, 6, and 7 (green) indicate a scheduled uplink data (the physical uplink shared channel) transmission.



Ex-1001, Fig. 2 (annotated). Thus, Papasakellariou discloses different resources for the uplink physical signal (SRS) and the uplink shared channel (uplink data). Ex-1003, ¶114.

- c. **1[b]/13[b] [a transmitter and the processor are configured to send]/[sending], over the physical uplink shared channel, data in assigned time intervals;**
- 7[b]/19[b] [a receiver and the processor are further configured to receive][receiving], over the physical uplink shared channel, data in assigned time intervals;**

Papasakellariou discloses these limitations because the “Node B 110 may schedule data transmissions for a given UE device 115A-C within its assigned RSMB.” Ex-1005, 6:48-50. Further, “the example mapper controller 125 receives instructions (e.g., from the example Node B 110 and/or the example resource assigner 120 via downlink control signaling) regarding whether, when and/or where to transmit reference and/or data signals. Ex-1005, 8:29-34; Ex-1003, ¶115.

Papasakellariou further discloses data transmissions occur in particular symbol time intervals (symbol time slots). Ex-1005, 5:15-17 (“The remainder of each slot is divided into six additional time intervals (symbols) that are reserved for uplink data and possibly control transmission.”).

Thus, Papasakellariou discloses a data transmission from a UE that is received by a Node B. Ex-1005, 7:54-55 (“Further, a UE device 115A-C having a scheduled uplink transmission in an RSMB”). A POSITA would have understood Papasakellariou discloses these limitations. Further, the claimed “time intervals” are one or more timeslots. Ex-1003, ¶117.

- d. **1[c]/13[c] [the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send]/[sending, in a time interval that it is not sending information over the physical uplink shared channel,] the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval;**

7[c]/19[c] [the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive]/[receiving, in a time interval that it is not receiving information over the physical uplink shared channel,] the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval;

Papasakellariou discloses these limitations. Ex-1003, ¶118.

- i. **sending/receiving, in a time interval that it is not sending/receiving information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information**

For example, Papasakellariou explains “[t]he remainder of each slot is divided into six additional time intervals (symbols) that are reserved for uplink data and possibly control transmission. One of these six time intervals per slot can be assigned

to Sounding RS transmissions.” Ex-1005, 5:15-19; *see supra* § VIII.A.1.b.iii. Here, a POSITA would have understood the symbol time interval for SRS transmissions is different from symbol time intervals for uplink data transmissions and thus a UE sends a SRS in a time interval in which it is not sending information on a physical uplink shared channel. Also, a network device receives a SRS in a time interval in which it is not receiving information on a physical uplink shared channel. Further, the claimed “time intervals” are one or more timeslots. Ex-1003, ¶119.

ii. wherein the uplink physical signal is used to determine channel conditions by a base station

Papasakellariou discloses these limitations. Ex-1003, ¶120. For example, Papasakellariou explains that a Node B (device 110) uses a signal-to-interference and noise ratio (SINR) calculator to determine channel conditions based on UE SRS transmissions.

To compute (e.g., estimate) channel conditions for UE devices (e.g., the example UE devices 115A-C of FIG. 1), the example device 110 of FIG. 7 includes an SINR calculator 710. Using any of number and/or type(s) of algorithm(s), method(s) and/or logic(s), the example SINR calculator 710 of FIG. 7 estimates SINR value(s) and/or CQI value(s) for the UE device(s) based on received SRS(s).

Ex-1005, 9:58-64.

Thus, Papasakellariou discloses wherein the uplink physical signal is used to determine channel conditions by a base station. Ex-1003, ¶121.

iii. in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval

For example, Papasakellariou explains that SRS signals are “chosen to partially or wholly satisfy the CAZAC property” and “have substantially zero cyclic autocorrelation (ZAC) (e.g., a cyclically shifted version of a signal S has substantially zero correlation with the signal S itself).” Ex-1005, 4:28-36. As explained in § VII.D, CAZAC signals are orthogonal and allow for concurrent transmissions. Papasakellariou further explains that a “Node B 110 can support a larger number of concurrent SRSs” and “different UEs can simultaneously transmit their SRS in correspondingly different RSMBs during the same SRS transmission period (e.g., SC-FDMA symbol).” Ex-1005, 6:54-61, 6:67-7:2.

Further, Papasakellariou explains “each of multiple UE devices 115A-C need to be able to transmit a separate SRS for CQI measurements, making the efficient multiplexing of such reference signals an important issue.” Ex-1005, 5:38-41. Further, “RSMBs allow the example resource assigner 120 to facilitate the multiplexing of the SRS transmissions for groups of UE devices 115A-C having similar channel conditions.” Ex-1005, 6:1-4.

The example Node B 110 of FIG. 1 instructs the UE devices 115A-C through downlink control signaling (through the physical and/or media access control (MAC) layers, also referred to as L1/L2 control, and/or through higher layers) when to transmit, in which RSMB(s) an SRS transmission should occur,

and which SRS (out of a number of available SRS) the UE should use for channel probing. The assignment of the above SRS transmission parameters can be such that **it achieves orthogonal SRS multiplexing** and/or reduces collisions among assigned SRSs in either RSMB.

Ex-1005, 7:28-37.

Thus, Papasakellariou discloses in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval. Further, the claimed “time intervals” are one or more timeslots. Ex-1003, ¶124.

- e. **1[d]/13[d] [the receiver and the processor are further configured to receive]/[receiving], on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.**

7[d]/19[d] [the transmitter and the processor are further configured to transmit]/[transmitting], on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the

physical control channel is based on a number of fields of control information to be sent to the UE.

Papasakellariou and Classon disclose these limitations. Ex-1003, ¶125.

- i. receiving/transmitting, on a physical control channel, control information, wherein the control information is based on the determined channel conditions**

Papasakellariou discloses the downlink control message generator transmits uplink data transmission assignments to the UE. Ex-1003, ¶126.

To schedule uplink data transmissions, the example device 110 of FIG. 7 includes a scheduler 735. Using any number and/or type(s) of algorithm(s), method(s) and/or logic(s), the example scheduler 735 of FIG.7 performs frequency and/or time channel-dependent scheduling of UE devices within the RSMBs allocated by the RSMB allocator. Such scheduling is based on the assignments of UE devices to RSMBs by the UE allocator. **Uplink data transmission assignments are transmitted to the UE devices via the DL control message generator 725.**

Ex-1005, 10:56-65. Here, the uplink data transmission assignments are control information, where the uplink data transmission assignments are transmitted by the network device and received by the user equipment. Ex-1003, ¶126.

Papasakellariou explains that “[c]hannel quality indication (CQI) measurements, which may also [be] obtained from received reference signals, can be used for purposes of user scheduling, link adaptation, interference coordination, handover, power control, and/or other purposes.” Ex-1005, 1:65-2:2. Also, “[c]hannel-dependent scheduling is widely known to improve throughput and/or

spectral efficiency in a wireless network by having the Node B assign an appropriate modulation and coding scheme for communication from and/or to a UE, depending on channel conditions, such as the received signal-to-interference and noise ratio (SINR), the UE experiences.” Ex-1005, 2:3-9.

Papasakellariou discloses the uplink data transmission assignments are based on the determined channel conditions because the “example resource manager 120 also assigns each of the UE devices 115A-C to a particular RSMB based on their associated CQI estimate.” Ex-1005, 6:34-36. Also, “the RSMB allocator assigns each UE to a channel condition group based on its associated SINR value (block. 815).” Ex-1005, 11:66-12:1.

A POSITA would have understood the uplink data transmission assignments are based on determined channel conditions and are transmitted by a Node B to the UE devices via the DL control message generator over a physical control channel. Ex-1003, ¶129.

- ii. **wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame**

For example, Classon explains a downlink frame structure as shown in Figure

5.

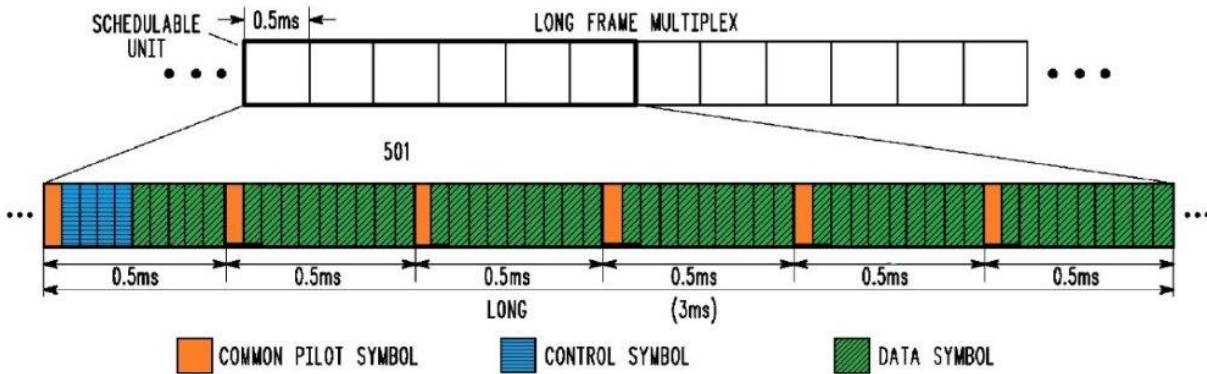


FIG. 5

Ex-1006, Fig. 5 (annotated). Here, “FIG. 5 shows a sequence of consecutive long frames.” Ex-1006, [0009]. Further, “[a]s an example, a common pilot or common reference symbol or common reference signal is time division multiplexed (TDM) onto the first symbol of each subframe, and control symbols are TDM onto the first symbols of each frame (other forms of multiplexing such as FDM, CDM, and combinations may also be used). Ex-1006, [0044].

In the annotation above, the common pilot or common reference symbol or common reference signal is shown in orange, control symbols are shown in blue, and data symbols are shown in green. A POSITA would have understood this plurality of slots is predetermined because the downlink frame structure dictates that the second, third, fourth, and fifth symbol times (physical control channels) are reserved for control symbols while the sixth, seventh, eighth, ninth, and tenth symbol times (data physical channels) are reserved for data symbols.

Classon further discloses (as annotated in blue) “[t]he control channel is preferably TDM (e.g., one or more TDM symbols), and located at or near the start of the frame.” Ex-1006, [0088]. Additionally, Classon explains that there may be a separate control channel for each user in a frame.

Therefore, when a control channel is present within a frame, it may allocate resources for one or more users. There may also be more than one control channel in a frame if a separate control channel is used for resource allocation for two users in the frame.

Ex-1006, [0089].

A POSITA would have understood the 4 blue control symbols represent a time slot of 0.2 ms (0.05 ms x 4 symbols) and that the blue control symbols may carry multiple physical control channels, each associated with a user. A POSITA would have further understood that the multiple user channels may be transmitted over the 4-symbol time slot using various multiplexing methods. Ex-1006, [0088] (“One or two-dimensional spreading and code division multiplexing (CDM) of the control information may also be employed.”). Ex-1006, [0044] (“control symbols are TDM onto the first symbols of each frame (other forms of multiplexing such as FDM, CDM, and combinations may also be used). Classon thus discloses a downlink frame with a physical control channel that is transmitted/received in a same time slot as other physical channels. Ex-1003, ¶¶134-135.

Alternatively, Figure 5 shows that in the first subframe (a 5 ms time slot) of a long frame, both control channels (blue) and data channels (green) are present. A POSITA would have understood that in this 5ms time slot of predetermined symbol time slots, physical control channels are transmitted with physical data channels. Thus, Classon discloses these limitations. Ex-1003, ¶¶136-137.

iii. wherein other time slots of the downlink frame do not include a physical control channel

For example, Classon discloses a long frame consists of 6 subframes of 0.5 ms each. As discussed above, the first subframe of a long frame includes both control symbol times (blue) and data symbol times (green). Classon further discloses that subframe 2 through subframe 6 (time slots) contains only data symbol times (green). For example, Classon discloses data subframes.

The method comprises the steps of receiving data to be transmitted over a radio frame, where the radio frame is comprised of a plurality of subframes. A frame duration is selected from two or more possible frame durations, where a frame is substantially equal to a multiple of subframes. The data is placed within the multiple subframes to produce multiple subframes of data, and the frame is transmitted having the multiple subframes of data over the radio frame.

Ex-1006, [0025].

Classon thus discloses that subframes 2-6 do not contain control symbols (blue) where a control channel could be transmitted. Ex-1003, ¶139.

- iv. wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE**

The '000 Patent describes the required resources of a physical control channel in terms of the number of bits in the fields to be sent to supported UEs on the channel.

The capacity of the PLCCH may be matched to the number of bits required in the feedback field and the number of UL_Beacon signals that can be simultaneously supported. That is, each UL_Beacon may correspond to one bit of the PLLCH.

Ex-1001, 5:13-19.

It is possible to extend the complexity of the control loop by sending control commands based on other aspects of the UL_Beacon signal as received by the base station, such as time-of-arrival, and channel impulse response. The amount of resource that is required for the feedback channel increases with the size (in bits) of the feedback information to each UE.

Ex-1001, 5:20-26.

Liu discloses these same aspects of a physical control channel. Ex-1003, ¶141. For example, Liu discloses an EU-RCSCH where “[t]he EU-RCSCH is a physical channel.” Ex-1007, 3:66-66. Further, Liu describes the EU-RCSCH as “a shared control channel for carrying control signal data in the downlink to a plurality of users.” Ex-1007, 3:56-58.

Liu further discloses the EU-RCSCH “includes fields identifiable by, or specified for, different ones of the users, so that each field includes control signal

data for a specified user for uplink transmission of the packet data.” The structure of the EU-RCSCH is shown below in Figure 2.

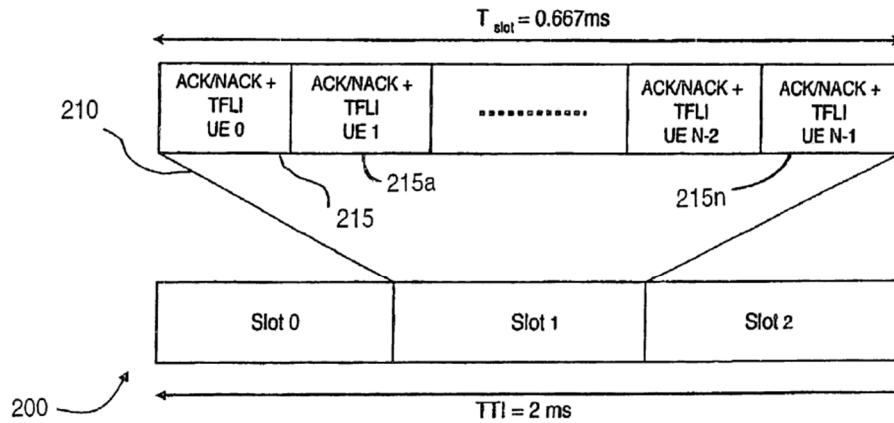


FIG. 2

Ex-1007, Fig. 2. Here, each slot “includes a plurality of fields 215” where “[e]ach field specifies a particular UE.” Ex-1007, 5:34-35. Liu further discloses “[e]ach field 215a . . . 215m may include ACK/NACK data (e.g., command) indicating whether a previous transmitted packet was received by a UE 105, and indicator data,” where “[t]he indicator data may be referred to as a Transport Format Limit Indicator (TFLI).” Ex-1007, 5:41-45.

Liu refers to the combination of the ACK/NACK data, the indicator (TFLI) data, and the UE designation (UE 1, UE 2, etc.) as a field. However, in the sense of the '000 Patent claims, the ACK/NACK data is a field and the indicator (TFLI) data is a field. Thus, a slot contains at least two claimed fields. Liu further discloses these two fields may have varying bit lengths as shown below. Ex-1003, ¶143.

The following UE specific bit allocations are suggested for the control signaling carried on the EU-RCSCH: (a) ACK/NACK 1 bit; (b) Transport format limit indicator (TFLI)–1 bit.

Ex-1007, 8:33-37.

The granularity of the TFLI field can be increase to 2 bits to allow different step sizes in moving the TFLI. The trade-off between the reduction on the noise rise (maintaining below the RoT threshold) due to faster reaction from the UE 105 and the performance loss due to increased EU-RCSCH errors should be evaluated.

Ex-1007, 9:13-18.

Although bit allocations of the ACK/NACK and TFLI fields have been described as 1-bit integers, the bit allocations could be N-bit values, N representing a positive integer greater than 1. Alternatively, bit allocations for the ACK/NACK and TFLI fields could be different positive integers.

Ex-1007, 9:36-40. Thus, Liu discloses that the number of bits sent over the EU-RCSCH would be calculated by adding the number of bits in the ACK/NACK data field to the number of bits in the indicator (TFLI) data field and then multiplying by the number of supported UEs. In this manner, the number of bits sent over the EU-RCSCH is based on a number of fields sent to a UE. Ex-1003, ¶143.

Further, Liu discloses “[t]he specified user decodes a corresponding field of the shared control channel to interpret the control signal data, and may transmit packet data in the uplink in accordance with the decoded control signal data.” Ex-1007, 2:42-54.

Further, the '000 Patent discloses each UE extracts relevant fields from the physical channel.

That is, each UL_Beacon may correspond to one bit of the PLLCH. All terminals transmitting UL_Beacon signals may receive this channel and extract the relevant feedback field.

Ex-1001, 5:16-19. This closely corresponds to the Liu disclosure of “[e]ach UE 105 listens to its assigned field 215 every Nth slot to decode the UE's specified signaling message.” Ex-1007, 6:20-24.

Thus, Liu discloses these limitations. Ex-1003, ¶146.

2. '000 Patent Dependent Claims

The dependent claims of the '000 Patent recite substantially overlapping subject matter related to transmissions/receptions between user equipment and a network device. Petitioners address related independent claims together.

- a. Claim 2/14. The [UE of claim 1, wherein the receiver and the processor are further configured to receive]/[method of claim 13 further comprising receiving] data on a physical downlink shared channel.**

Claim 8/20. The [network device of claim 7, wherein the transmitter and the processor are further configured to transmit]/[method of claim 19 further comprising transmitting] data on a physical downlink shared channel.

Classon discloses these claims as shown in the long frame structure in Figure

5. Ex-1003, ¶148. For example, as discussed in § VIII.A.1.e.ii, the downlink frame

structure dictates that, for subframe 1, the sixth, seventh, eighth, ninth, and tenth symbol times (data physical channels), and all of the symbols (with the exception of the pilot symbols) of subframes 2-6 are reserved for data symbols. Further, Classon discloses “the data transmission may be a downlink transmission or an uplink transmission.” Ex-1006, [0043].

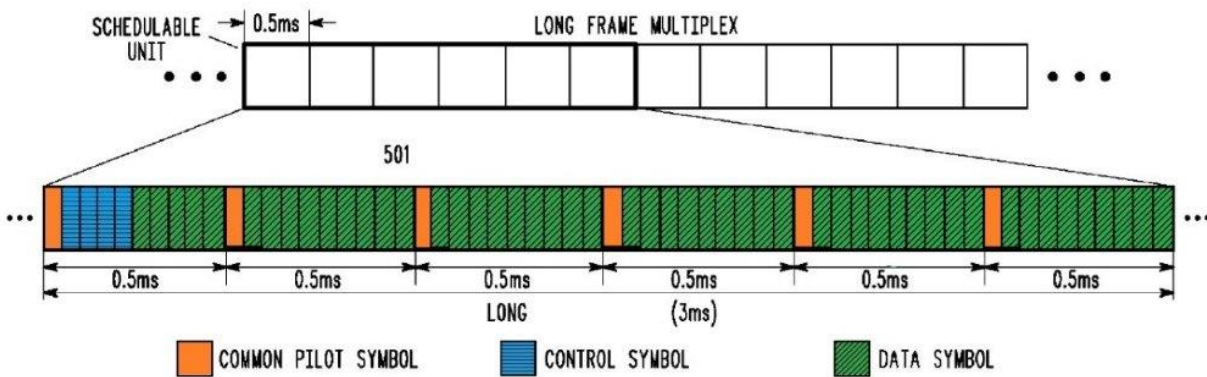


FIG. 5

Ex-1006, Fig. 5 (annotated).

Further, Classon discloses “[a] frame has an associated control structure possibly uniquely associated—that controls the usage (allocation) of the resource to users.” Ex-1006, [0088]. This allocation, as shown in Figure 5, is a physical downlink data channel. Further, the data allocations are shared because “when a control channel is present within a frame, it may allocate resources for one or more users” and “[t]here may also be more than one control channel in a frame if a separate control channel is used for resource allocation for two users in the frame.” Ex1006, [0089].

Thus, in the contest of Classon's downlink long frame structure, a network device transmits data, and a UE receives data on a physical downlink shared channel.

Ex-1003, ¶150.

- b. Claim 3/15. The [UE of claim 2]/[method of claim 14], wherein the physical control channel and the physical downlink shared channel are time multiplexed.**

Claim 9/21. The [network device of claim 8]/[method of claim 20], wherein the physical control channel and the physical downlink shared channel are time multiplexed.

Classon discloses “a common pilot or common reference symbol or common reference signal is time division multiplexed (TDM) onto the first symbol of each subframe, and control symbols are TDM onto the first symbols of each frame.” Ex-1006, [0044]. Further, “[t]he control channel is preferably TDM (e.g., one or more TDM symbols), and located at or near the start of the frame,” Ex-1006, [0088]. Classon shows the TDM nature of the physical control channel and the physical downlink shared channel in Figure 5 as discussed in § VIII.A.2.a.

Thus, Classon discloses these claims. Ex-1003, ¶152.

- c. Claim 4/16. The [UE of claim 1, wherein the receiver and the processor are further configured to receive]/[method of claim 13 further comprising receiving], on the physical control channel, power control information.**

Claim 10/22. The [network device of claim 7, wherein the transmitter and the processor are further configured to transmit]/[method of claim 19 further

comprising transmitting], on the physical control channel, power control information.

Lui discloses these claims because the TFLI data, discussed in § VIII.A.1.e.iv, includes power control information as shown below. Ex-1003, ¶153.

A TFLI represents an upper bound or limit for a transmit rate, and may inform the UE whether or not to adjust its transmit rate, and in which direction (**raise transmit power, lower transmit power, maintain transmit power**). Since the EU-RCSCH is shared by a plurality of UEs, a UE only needs to decode one field of one UE, instead of all fields of a plurality of shared control channels, potentially conserving downlink bandwidth.

Ex-1007, 4:14-28.

The TFLI specifies a maximum allowable transmit rate and informs the UE 105 whether or not to adjust its transmit rate, and in which direction (**raise transmit power, lower transmit power, maintain transmit power**).

Ex-1007, 5:34-48.

Additionally, a scheduler at the Node B 110 would estimate the channel for each UE 105 and the amount of “headroom” or margin available to the RoT threshold, in determining which UEs 105 can transmit and at what rate (**or equivalently at what transmit power**).

Ex-1007, 6:37-42.

Thus, Lui discloses a network device transmitting and a UE receiving TFLI information over the EU-RCSCH, where the TFLI contains power control information. Ex-1003, ¶154.

- d. **Claim 5/17. The [UE of claim 4]/[method of claim 16], wherein the physical control channel includes power control information for a plurality of UEs using different bits.**

Claim 11/23. The [network device of claim 10]/[method of claim 22], wherein the physical control channel includes power control information for a plurality of UEs using different bits.

Liu discloses these claims because the frame structure shown in Figure 2 includes specific fields containing specific bits for specific UEs. Ex-1003, ¶155.

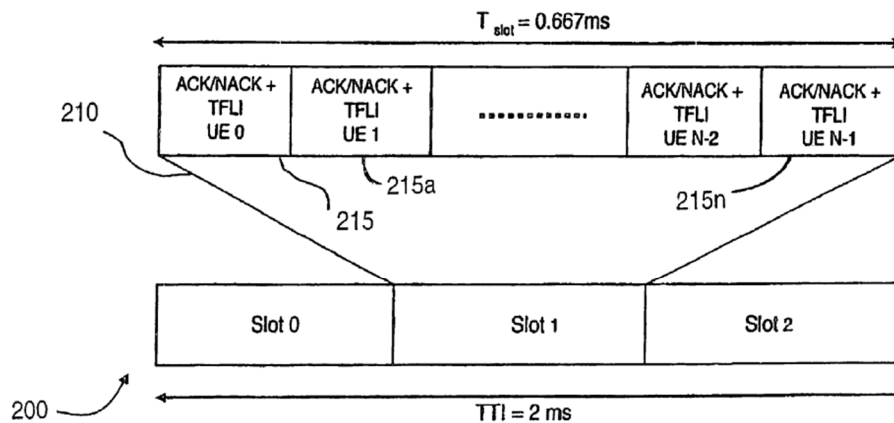


FIG. 2

Ex-1007, Fig. 2. Further, Liu discloses a UE is assigned a particular field and only needs to decode that particular field.

In FIG. 2, Slot 1 is shown in exploded view and includes a plurality of fields 215. **Each field specifies a particular UE;** thus the EU-RCSCH is shared by a plurality of UEs 105. As discussed above, UE 105 only needs to decode one field 215 of one UE 105, instead of all fields of a plurality of shared control channels.

Ex-1007, 5:34-39.

Additionally, Lui discloses the UE field assignment is performed when a UE connects to the network.

Generally, the RNC 115 assigns fields to the UEs 105. In particular, the field 215 within a slot 210 of the EU-RCSCH sub-frame 200 that a UE 105 is to listen to may be assigned directly by the RNC 115 serving the UE 105. Accordingly, since this is done at call setup, the field 215 is assigned in advance of receiving the EU-RCSCH.

Ex-1007, 8:7-12.

Thus, Lui discloses wherein the physical control channel includes power control information for a plurality of UEs using different bits. Ex-1003, ¶157.

- e. **Claim 6/18. The [UE of claim 1]/[method of claim 13], wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.**

Claim 12/24. The [network device of claim 7]/[method of claim 19], wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

Classon discloses these claims because, with respect to Figure 5 (in an uplink scenario), Classon explains “control symbols are TDM onto the first symbols of each frame (other forms of multiplexing such as FDM, CDM, and combinations may also be used). Ex-1008, [0044]. Annotated Figure 5 shows these control symbols in blue. Ex-1003, ¶158.



Further, Classon discloses that “for uplink (UL) transmissions, the radio frame structure may additionally be used to define contention channels (e.g. random access channel (RACH)), control channels including pilot time multiplexed with the shared data channel.” Ex-1006, [0040].

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B. Ground 2: Claims 1-24 are obvious over Muharemovic in view of Onggosanusi and further in view of Classon

1. '000 Patent Independent Claims

The independent claims of the '000 Patent recite substantially overlapping subject matter related to transmissions/receptions between user equipment and a network device. Petitioners address the independent claims together.

a. 1[pre] A user equipment (UE) comprising:

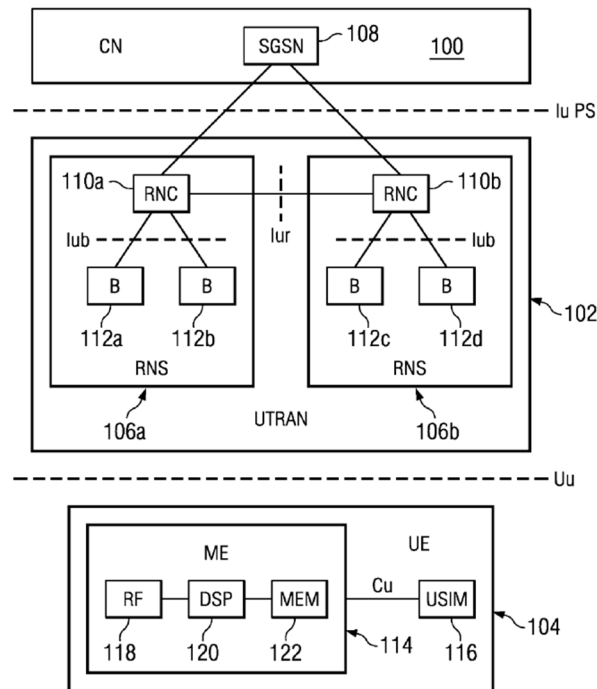
7[pre] A network device comprising:

13[pre] A method performed by user equipment (UE), the method comprising:

19[pre] A method performed by a network device, the method comprising:

To the extent the preambles are limiting, Onggosanusi discloses these preambles. For example, Onggosanusi describes “an example of a network architecture of a wireless telecommunications system”, as shown in Figure 1, where “[t]he wireless telecommunications system may be divided into a core network (CN) 100, a UMTS terrestrial radio access network (UTRAN) 102, and user equipment (UE) 104.” Ex-1016, 2:63-64, 3:13-15. Further, “[t]he UTRAN 102 includes radio network sub-systems (RNS) 106A, 106B, each of which includes at least one radio network controller (RNC) 110A, 110B and nodes B also referred to as base station 112A, 112B, 112C, 112D.” Ex-1016, 3:32-35.

FIG. 1



Ex-1016, Fig. 1.

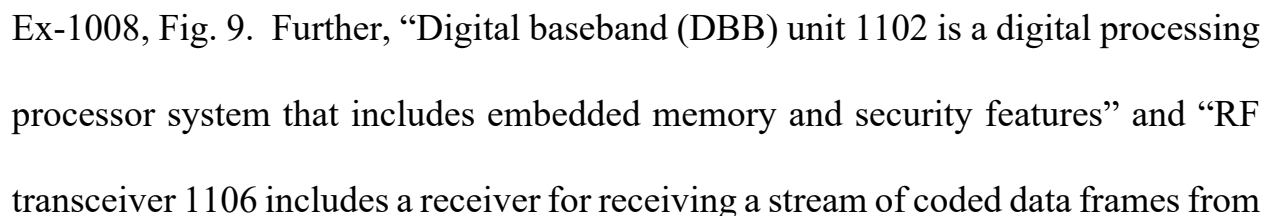
Further, Onggosanusi discloses “FIG. 3 is a flowchart presenting a method in accordance with an embodiment of the invention,” where a “network entity, Node B or a base station for example, measures the uplink channel.” Ex-1016, 5:23-27. Thus, Onggosanusi discloses these preambles. Ex-1003, ¶163.

- b. **1[a]/13[a] [a receiver and a processor are configured to receive]/[receiving] resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;**

7[a]/19[a] [a transmitter and a processor are configured to transmit]/[transmitting] resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and

Muharemovic and Onggosanusi disclose these limitations. Ex-1003, ¶164.

Muharemovic discloses a UE, shown in the figure below, where “a block diagram of another digital system 1100 with an embodiment of transmitter level power control, as described above,” where “[d]igital system 1100 a representative cell phone that is used by a mobile user.” Ex-1008, [0056].



a cellular base station via antenna 1107 and a transmitter for transmitting a stream of coded data frames to the cellular base station via antenna 1107.” Ex-1008, [0056], [0058].

Also, Onggosanusi discloses “[t]he node B 112A, 112B, 112C, 112D implements the Uu interface, through which the user equipment 104 may access the network infrastructure. Some functions of the base station 112A, 112B, 112C, 112D may be implemented with a digital signal processor, memory, and computer programs for executing computer processes” and “[t]he basic structure and operation of the base station 112A, 112B, 112C, 112D are known to one skilled in the art.” Ex-1016, 3:49-58.

Further, “[t]he user equipment 104 further includes a digital signal processor 120, memory 122, and computer programs for executing computer processes” and “[t]he user equipment 104 may further comprise an antenna, an RF components adapted to adjust the transmission power in response to a slow power.” Ex-1016, 3:63-67. Also, “[t]he basic structure and operation of the user equipment 104 are known to one skilled in the art.” Ex-1016, 4:14-15.

A POSITA would have understood these implementations of network devices and user equipment would include processors/receivers/transmitters configured to receive/transmit. Ex-1003 ¶168.

ii. receiving/transmitting resource allocation information associated with an uplink physical signal

For example, Muharemovic discloses “[a] serving site informs the UE about the scheduled channels, as well as a transmit PSD offset on scheduled channels relative to the SRS PSD.” Ex-1008, [0016]. Further, “[t]he scheduled MCS as well as the scheduled channels are communicated to each scheduled UE through downlink channels.” Ex-1008, [0050].

Each UE transmits a sounding reference signal (SRS), in order to provide channel condition estimation at the cell site (among other purposes). In this embodiment, SRS can span all available channels in the system to provide maximum diversity gain. It is not precluded that SRS can span a subset of available channels in the system. Further, in this embodiment, SRS is sent every scheduling period. It is not precluded that in other embodiments, SRS may be sent more or less frequently.

Ex-1008, [0044]. Further, “[s]cheduled transmissions in a multi-channel scheduled communication system include both sounding reference signal and data transmission in sub-frames.” Ex-1008, Abstract.

Thus, because the SRS is sent every scheduling period, the information regarding scheduled channels that are communicated to each scheduled UE through downlink channels is resource allocation information associated with an uplink physical signal. As this information is sent on downlink channels, the information is transmitted by a cell site and received by a UE. Ex-1003, ¶170.

Further, Classon discloses the signaling of pilot symbol allocations.

Pilot symbol allocations may be constant, or may be signaled. For example, common pilot symbol locations may be signaled within the radio frame control for one or more RAFs. In another example, a dedicated pilot (in addition to any common pilot) is indicated in a frame within the RA control for the frame.

Ex-1008, [0094]. A POSITA would have understood the signaling of pilot allocations would be transmitted by a base transceiver station (BTS, or base station) and received by a remote, or mobile unit. Ex-1003, ¶171.

iii. wherein the uplink physical signal and a physical uplink shared channel have different resources

For example, Muharemovic discloses “a plot of scheduled transmissions illustrating transmission by a user device in the network of FIG. 1, including the transmission of a sounding reference signal as well as scheduled transmissions.” Ex-1008, [0044].

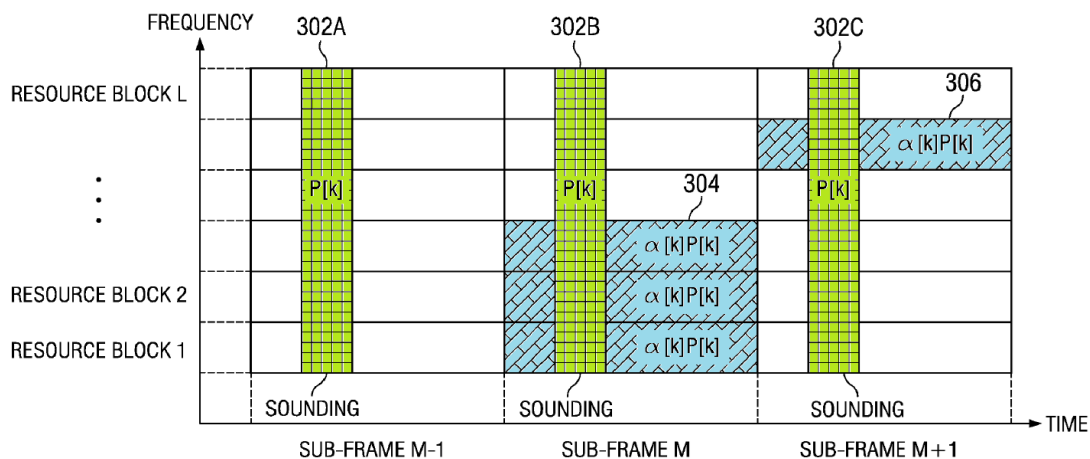


FIG. 3

Ex-1008, Fig. 3 (annotated).

As Figure 3 shows, the sounding reference signal (green) is transmitted during a time slot when no scheduled data transmissions (blue) occur. Thus, in the time-frequency resource map shown in Figure 3, the sounding reference signal and the scheduled data transmissions have different resources. Ex-1003, ¶173.

Further, the scheduled data transmissions occur in a shared channel.

In high data rate communication systems, the resources are typically divided into a number of parallel channels, where a channel can be a subset of resources determined by any available resource partitioning schemes. For example, each channel can consist of a set of sub carriers, for frequency division multiplex transmission. Based on UE channel conditions as well as UE traffic properties, a scheduler in each cell site schedules a subset of UEs for transmission on available channels, as well as the modulation and coding scheme (MCS) each scheduled UE should employ on its scheduled channels.

Ex-1008, [0042].

Thus, Muharemovic discloses these limitations. Ex-1003, ¶175.

- c. **1[b]/13[b] [a transmitter and the processor are configured to send]/[sending], over the physical uplink shared channel, data in assigned time intervals;**
7[b]/19[b] [a receiver and the processor are further configured to receive][receiving], over the physical uplink shared channel, data in assigned time intervals;

Muharemovic discloses these limitations. Ex-1003, ¶176. For example, Muharemovic discloses “a plot of scheduled transmissions illustrating transmission

[illegible]

Ex-1008, Fig. 3 (annotated).

transmitting data from the UE with a transmission power that depends on the SRS transmission power, the allocated frequency channels, and the PSD offset value.

Ex-1008, claim 1. Thus, Muharemovic discloses these limitations. Further, the claimed “time intervals” are one or more timeslots. Ex-1003, ¶177.

- d. **1[c]/13[c] [the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send]/[sending, in a time interval that it is not sending information over the physical uplink shared channel,] the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval;**

7[c]/19[c] [the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive]/[receiving, in a time interval that it is not receiving information over the physical uplink shared channel,] the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval;

Muharemovic and Classon disclose these limitations. Ex-1003, ¶178.

- i. **sending/receiving, in a time interval that it is not sending/receiving information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information**

For example, Muharemovic discloses “a plot of scheduled transmissions illustrating transmission by a user device in the network of FIG. 1, including the transmission of a sounding reference signal as well as scheduled transmissions.” Ex-1008, [0044].

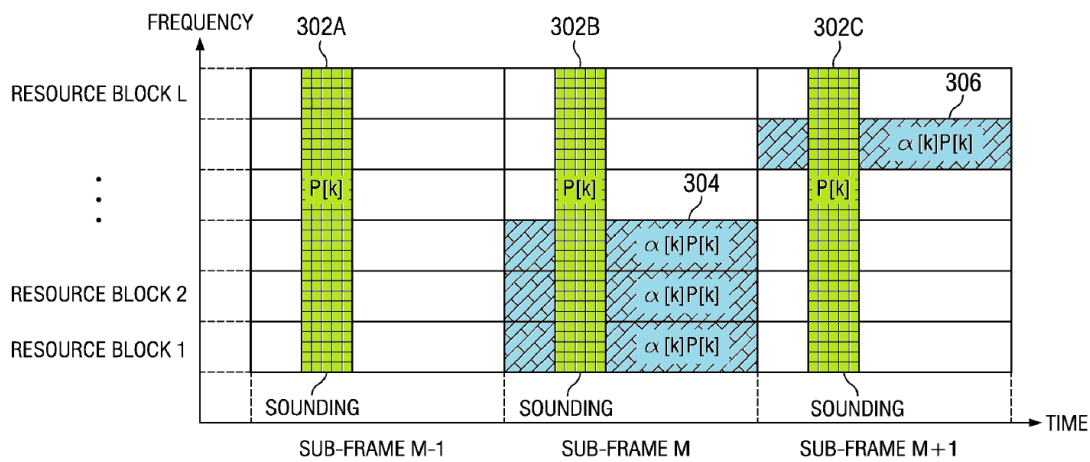


FIG. 3

Ex-1008, Fig. 3 (annotated).

As Figure 3 shows, the sounding reference signal (green) is transmitted during a time slot when no scheduled transmissions (blue) occur. Thus, Muharemovic discloses these limitations. Further, the claimed “time intervals” are one or more timeslots. Ex-1003, ¶180.

ii. wherein the uplink physical signal is used to determine channel conditions by a base station

For example, Muharemovic explains “[e]ach UE transmits a sounding reference signal (SRS), in order to provide channel condition estimation at the cell site (among other purposes).” Ex-1008, [0044]. In more detail, Muharemovic explains cell sites measure the SRS signal strength and perform a power assessment.

Each cell site monitors the received SRS signal strength from non-serving UEs. In this case, the SRS can be regarded as the signature code of each UE. After measuring the received SRS signal strength at a cell site, a power assessment can be evaluated at the cell site and subsequently communicated to the serving site of the UE.

Ex-1008, [0055].

Thus, Muharemovic discloses wherein the uplink physical signal is used to determine channel conditions by a base station. Ex-1003, ¶182.

iii. in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval

For example, in Figure 3, Muharemovic discloses “a plot of scheduled transmissions illustrating transmission by a user device in the network of FIG. 1, including the transmission of a sounding reference signal as well as scheduled transmissions.” Ex-1008, [0044].

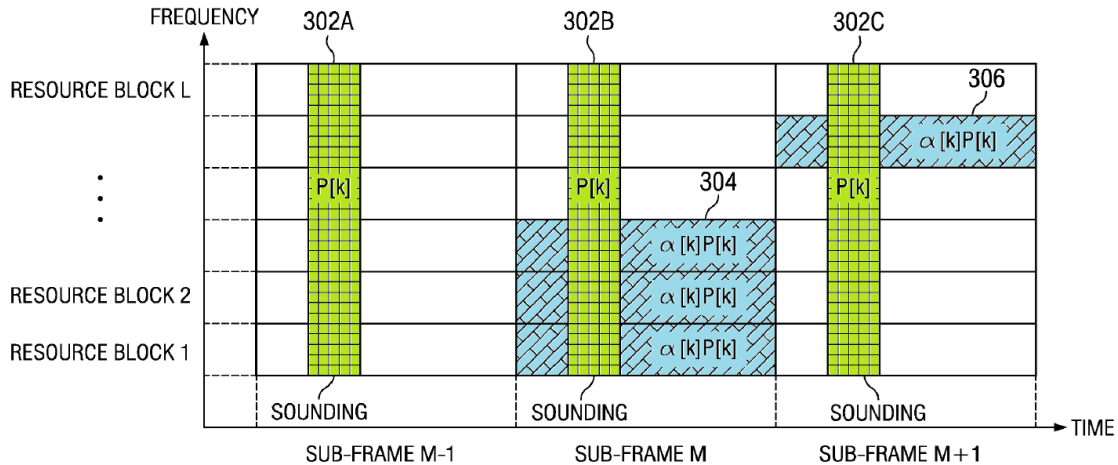


FIG. 3

Ex-1008, Fig. 3 (annotated). While Figure 3 shows the transmissions of a particular UE, Muharemovic further discloses that “[e]ach UE transmits a sounding reference signal (SRS), in order to provide channel condition estimation at the cell site (among other purposes). Ex-1008, [0044].

Further, Muharemovic explains that “[i]n sub-frame M-1 no scheduled transmission is present from this UE, because other UEs are scheduled.” Ex-1008, [0053]. A POSITA would have understood that all UEs in a cell site would transmit their respective SRS in the same time interval because the remaining time in a subframe is dedicated to schedules data transmissions. Ex-1003, ¶184.

Indeed, Classon discloses this simultaneous transmission. Ex-1003, ¶185.

Pilot or reference symbols may be multiplexed in a frame or a subframe by TDM, FDM, CDM, or various combinations of these. Pilot symbols may be common (to be received and used by any user) or dedicated (for a specific user or a specific group of users), and a mixture of common and dedicated pilots may exist in a frame.

Ex-1008, [0094].

Thus, Muharemovic and Classon disclose these limitations. Further, the claimed “time intervals” are one or more timeslots. Ex-1003, ¶186.

- e. **1[d]/13[d] [the receiver and the processor are further configured to receive]/[receiving], on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.**

7[d]/19[d] [the transmitter and the processor are further configured to transmit]/[transmitting], on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Muharemovic, Onggosanusi, and Classon disclose these limitations. Ex-1003, ¶187.

- i. **receiving/transmitting, on a physical control channel, control information, wherein the control information is based on the determined channel conditions**

For example, Muharemovic discloses “the serving cell site issues the power control command to that particular served UE by transmitting message C1 in downlink channels.” Ex-1008, [0037]. In more detail, Muharemovic Figure 2 explains the power control command.

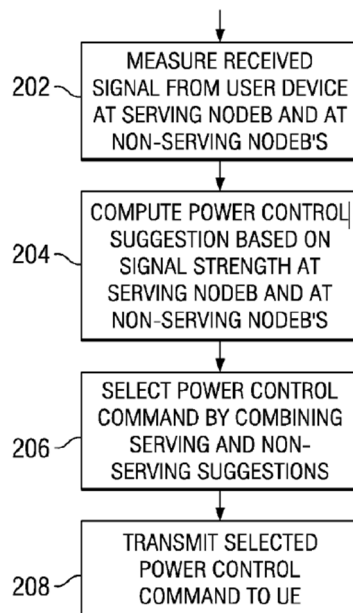


FIG. 2

Ex-1008, Fig. 2.

Here, step 204 shows the power control command is based on the determined channel conditions, where “[b]ased on the measured signal strength from a UE, both the non-serving cell sites and the serving cell site compute 204 power assessments on the particular UE.” Ex-1008, [0039].

A POSITA would have understood the Muharemovic “power control command” is control information based on determined channel conditions and “transmitting message C1 in downlink channels” discloses a network device transmitting and a UE receiving, on a physical control channel, this control information. Ex-1003, ¶190.

Further, Onggosanusi discloses either a dedicated downlink channel or an existing downlink channel for sending/receiving a slow power command. Ex-1016, 6:41-42 (“A dedicated downlink channel is used to send the slow power control command.”); Ex-1016, 6:50-51 (“The slow power control command is sent (fed back) via an existing downlink channel.”).

Onggosanusi explains the slow power command as being derived from UE transmitted pilot sequences.

An uplink control channel, such as an uplink DPCCH (Dedicated Physical Control Channel) defined in the 3GPP (3rd Generation Partnership Project) specification, transmitted by the user equipment 200 includes pilot sequences. The network infrastructure 200 receives the pilot sequences and estimates signal quality parameters, such as SIR (Signal-to-Interference Ratio), of the uplink DPCCH 204.

Ex-1016, 4:26-33.

The network infrastructure 200 generates slow power control commands on the basis of the signal quality parameters and transmits the slow power control commands to the user equipment 202 over a downlink control channel 206, such as a downlink DPCCH.

Ex-1016, 4:39-43.

A POSITA would have understood the Onggosanusi “slow power control command” is control information based on determined channel conditions and “transmitting the slow power control command to the user equipment over a downlink control channel” discloses a network device transmitting and a UE receiving, on a physical control channel, this control information. Ex-1003, ¶193.

- ii. wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame**

Classon discloses these limitations. *See supra* § VIII.A.1.e.ii.

- iii. wherein other time slots of the downlink frame do not include a physical control channel**

Classon discloses these limitations. *See supra* § VIII.A.1.e.iii.

- iv. wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE**

For example, Onggosanusi discloses that “[a]fter the base station determines the UE transmit power, it sends a command to each of the scheduled UEs to increase, decrease, or maintain its transmit power.” Ex-1016, 6:37-40. Further, the command may include a variable bit codeword.

Depending on the number of bits in the power control codeword, different power control increment may result. For example, with 1-bit codeword, the base station can only command the UE to increase or

decrease its power by X dB, where X can be any number. A 3-level command can also be issued (increase, decrease, no change). In general, with N bits, 2^N power levels can be used.

Ex-1016, 6:42-49.

Additionally, both the dedicated downlink channel and the existing downlink channel have a varying number of fields, where the fields are codewords with varying numbers of bits. Onggosanusi explains that “the power control codeword may be included in the down link shared control channel once every many (for example, hundreds) transmissions of that channel” and “said network element transmits a power control command to at least one user equipment using a downlink control channel shared among multiple user equipments, wherein the transmission of the power control command to at least one user equipment is at a rate that is slower than a transmission time interval (TTI).” Ex-1016, 6:58-61, 7:53-59.

Thus, because the transmission rate of power control command is less than a TTI, various UEs receive power control commands in various TTIs. In other words, not all UEs will receive a power control command in the same TTI. A POSITA would have understood the number of bits sent over the Onggosanusi downlink shared channels is based on a number of fields (codewords) is based on the number of UEs serviced in that particular TTI. Ex-1003, ¶198.

Further, Onggosanusi explains the command “is sent (fed back) via an existing downlink channel,” where “[f]or example, this channel can be the downlink shared control channel used to provide scheduling grants to user equipments for uplink transmission.” Ex-1016, 6:50-54. A POSITA would have understood the number of bits sent over the Onggosanusi downlink shared channels that includes both power control and scheduling grants further discloses these limitations because a POSITA would have understood the scheduling grants are also fields defined by a number of bits. Thus, a POSITA would have understood a varying mixture of power control commands and scheduling grants discloses these limitations. Ex-1003, ¶199.

2. ’000 Patent Dependent Claims

The dependent claims of the ’000 Patent recite substantially overlapping subject matter related to transmissions/receptions between user equipment and a network device. Petitioners address related independent claims together.

- a. Claim 2/14. The [UE of claim 1, wherein the receiver and the processor are further configured to receive]/[method of claim 13 further comprising receiving] data on a physical downlink shared channel.**

Claim 8/20. The [network device of claim 7, wherein the transmitter and the processor are further configured to transmit]/[method of claim 19 further comprising transmitting] data on a physical downlink shared channel.

Classon discloses these claims. *See supra* § VIII.A.2.a. Ex-1003, ¶201.

- b. **Claim 3/15. The [UE of claim 2]/[method of claim 14], wherein the physical control channel and the physical downlink shared channel are time multiplexed.**

Claim 9/21. The [network device of claim 8]/[method of claim 20], wherein the physical control channel and the physical downlink shared channel are time multiplexed.

Classon discloses these claims. *See* § VIII.A.2.b. Ex-1003, ¶202.

- c. **Claim 4/16. The [UE of claim 1, wherein the receiver and the processor are further configured to receive]/[method of claim 13 further comprising receiving], on the physical control channel, power control information.**

Claim 10/22. The [network device of claim 7, wherein the transmitter and the processor are further configured to transmit]/[method of claim 19 further comprising transmitting], on the physical control channel, power control information.

Muharemovic discloses these claims because the power control command is power control information. Ex-1003, ¶203.

Upon receiving power assessments on a particular UE from neighboring non-serving cell sites, the serving cell site combines 208 the available power assessments from non-serving cell sites, together with its own measurement of information, the received signal strength of that particular UE. From this combination, the serving cell site obtains 208 a power control command for that particular UE and transmits 210 the power control command to that UE.

Ex-1005, [0041].

Onggosanusi discloses these claims because the power control command is power control information. Ex-1003, ¶204.

At 360, depending on the slow power control command from the base station, the UE adjusts its transmit power accordingly.

Ex-1016, 7:5-8.

- d. **Claim 5/17. The [UE of claim 4]/[method of claim 16], wherein the physical control channel includes power control information for a plurality of UEs using different bits.**

Claim 11/23. The [network device of claim 10]/[method of claim 22], wherein the physical control channel includes power control information for a plurality of UEs using different bits.

Muharemovic discloses these claims because “all power control commands can be transmitted in a common downlink channel that is readable by all UEs served in a cell site.” Ex-1008, [0034].

Onggosanusi discloses these claims because “[a]fter the base station determines the UE transmit power, it sends a command to each of the scheduled UEs to increase, decrease, or maintain its transmit power, 350.” Ex-1016, 6:37-39.

A POSITA would have understood that both Muharemovic and Onggosanusi disclose a UE is provided a separate power command with different bits. Ex-1003, ¶¶205-207.

- e. **Claim 6/18.** The [UE of claim 1]/[method of claim 13], wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

Claim 12/24. The [network device of claim 7]/[method of claim 19], wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

Classon discloses these claims. *See supra* § VIII.A.2.e. Ex-1003, ¶208.

IX. CONCLUSION

Inter partes review of the challenged claims is respectfully requested.

X. MANDATORY NOTICES

A. Real Party in Interest

Petitioners identify themselves as real parties in interest.

B. Related Matters

To the best of Petitioners' knowledge, the '000 Patent has been involved in the following related matters:

- *Intellectual Ventures I LLC et al. v. American Airlines, Inc.*, No. 24-cv-980 (E.D. Tex. filed November 2, 2024)
- *Intellectual Ventures I LLC et al. v. American Airlines, Inc.*, No. 25-cv-576 (E.D. Tex. filed May 30, 2025)
- *Intellectual Ventures I LLC et al. v. Southwest Airlines, Co.*, No. 24-cv-277 (W.D. Tex. filed November 2, 2024)

Petitioners are not aware of any other civil actions or proceedings filed in connection with the '000 Patent.

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Petitioners consent to service by email to the counsel above.

D. Service information

USPTO records show the attorneys having power of attorney over the '000 Patent are Volpe Koenig. This petition is thus being served by Federal Express to the correspondence address for the '000 Patent, Volpe Koenig, 30 South 17th Street, 18th Floor, Philadelphia, PA 19103. Petitioners consent to electronic service at AA_Intellectual_Ventures@mckoolsmith.com.

XI. FEE PAYMENT

The Office is allowed to charge the fees specified by 37 C.F.R. §§ 42.103(a) and 42.15(a) to Deposit Account No. 50-5723.

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CERTIFICATION OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 13,964 words, according to the word-processing system used to prepare this petition, excluding parts of this petition that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

Dated: September 12, 2025

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.106, that a complete copy of the attached **PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,032,000 B2**, including all exhibits (**Nos. 1001-1029**) and related materials, are being served by Federal Express on 12th day of September, 2025, the same day as the filing of the above-identified document in the United

States Patent and Trademark Office/Patent Trial and Appeal Board, upon Patent

Owner by serving the correspondence address of record with the USPTO as follows:

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