IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,

LENOVO (UNITED STATES) INC.,

MOTOROLA MOBILITY LLC

Petitioners,

v.

COLLISION COMMUNICATIONS, INC.,

Patent Owner.

Case No. IPR2025-00301

U.S. Patent No. 9,814,071

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,814,071

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EXHIBIT LIST

Ex.	Description
1001	U.S. Patent No. 9,814,071 ("the '071 patent")
1002	'071 Original Prosecution History
1003	Declaration of Paul Min
1004	U.S. Patent Application Publication No. 2005/0286408 ("Jin")
1005	U.S. Patent No. 5,867,478 ("Baum")
1006	U.S. Patent Application Publication No. 2010/0054200 ("Tsai")
1007	U.S. Patent Application Publication No. 2014/0161068 ("Vrzic")
1008	Verdu, Sergio, "Multiuser Detection," Cambridge University Press (1998)
1009	Verdu, Sergio, "Computational Complexity of Optimum Multiuser Detection," Algorithmica (1989)
1010	Petition for Inter Partes Review, *Ericsson Inc. and Nokia of Am. Corp. v. Collision Commc'n*, *Inc.*, IPR2022-01233, Paper 3 (PTAB July 20, 2022)
1011	Patent Owner's Preliminary Response, *Ericsson Inc. and Nokia of Am. Corp. v. Collision Commc'n*, *Inc.*, IPR2022-01233, Paper 7 (PTAB Oct. 26, 2022)
1012	Institution Decision, *Ericsson Inc. and Nokia of Am. Corp. v. Collision Commc'n*, *Inc*, IPR2022-01233, Paper 12 (PTAB Jan. 19, 2023)

Ex.	Description
1013	Collision's Preliminary Infringement Contentions, *Collision Communications*, *Inc. v. Samsung Electronics Co. Ltd et al*, 2-23-cv-00587 (EDTX), Ex. 6
1014	U.S. Patent No. 6,947,505
1015	Dr. Paul Min's Curriculum Vitae
1016	Federal Court Management Statistics (September 2024).
1017	Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (USPTO June 21, 2022) ("Guidance Memo")
1018	Standing Order Regarding Readiness for Scheduling Conference (Judge Rodney Gilstrap, E.D. Tex., December 20, 2011), *available at* www.txed.uscourts.gov/sites/default/files/judgeFiles/12-20-11%20Standing%20Order%20%20re%20Readiness%20for%20Scheduling%20Conference.pdf
1019	Docket Control Order, Dkt. No. 44, *Collision Communications, Inc.* v. *Lenovo Group Ltd,* 2-23-cv-00594 (E.D. Tex.)
1020	Additional Declaration of Dr. Paul Min

LIST OF CHALLENGED CLAIMS

Claim	Limitation
1pre	A method for enabling a receiving node to distinguish information simultaneously received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:

Claim	Limitation
1a	providing a plurality of parameter channels on the network in addition to the shared communication channel;
1b	requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel;
1c	detecting the parameter-estimating signals on the unshared parameter channels and estimating therefrom at least one unique signal parameter for each of the transmitting nodes; and
1d	detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.
2	The method of claim 1, wherein said providing a plurality of parameter channels comprises using channel-spreading technology.
3	The method of claim 2, wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.
4	The method of claim 1, wherein requiring each transmitting node to transmit a parameter-estimating signal includes requiring each transmitting node to transmit the parameter-estimating signal while simultaneously transmitting information on the shared communication channel.
5	The method of claim 1, wherein the parameter-estimating signal is a parameter-estimating symbol pattern.
6	The method of claim 1, wherein the at least one unique signal parameter comprises signal amplitude.

Claim	Limitation
7	The method of claim 1, wherein the at least one unique signal parameter includes a signal phase.
8	The method of claim 1, wherein the at least one unique signal parameter includes a signal carrier frequency offset.
9	The method of claim 1, wherein the at least one unique signal parameter includes a signal relative time delay.
10	The method of claim 1, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.
11	The method of claim 1, further comprising requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.
16	The method of claim 1, wherein the parameter channels are low in communication rate compared to the shared communication channel.
21pre	A method for enabling a receiving node to distinguish information concurrently received from a plurality of transmitting nodes on a shared communication channel of a wireless digital network, the method comprising:
21a	receiving a plurality of parameter-estimating signals each on an unshared parameter channel from a corresponding transmitting node;
21b	estimating at least one unique signal parameter for each of the received plurality of parameter-estimating signals; and

Claim	Limitation
21c	distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter.

I. INTRODUCTION

Petitioners Intel Corporation ("Intel"), Lenovo (United States) Inc., and Motorola Mobility LLC (collectively "Petitioners") request *Inter Partes* Review ("IPR") of claims 1-11, 16, and 21 of the '071 patent. Petitioners also file a contingent motion to join the IPR in *Samsung Electronics America, Inc., et al. v. Collision Communications, Inc.,* Case No. IPR2024-01248 ("the Samsung IPR"), in which Samsung is challenging the same claims on the same grounds.[1] Petitioners submit this petition to preserve their rights if the Samsung Petition is denied for reasons other than the likelihood of prevailing at trial.

The '071 patent is directed to a purported improvement to the well-known technique of multi-user detection ("MUD"), which allows differentiation of data streams directed to different users where multiple devices transmit signals simultaneously over a shared communication channel, each carrying its own information. These devices, which are all using the same channel, interfere with one

[1] Petitioners have retained Paul Min, Ph.D. in this proceeding. EX1020. Dr. Min has adopted his prior opinions set forth in EX1003 (submitted in IPR2024-01248) and, for expediency, this Petition cites to Dr. Min's previously submitted declaration, also presented herein as EX1003.

another, and techniques are required to demodulate and otherwise ascertain which signal is directed to which user. This technology, MUD, was not invented by the '071 patent. The prior art describes many techniques for doing so.

Wireless communication technologies allow multiple users to send data over the same transmission channels. Because data may be transmitted to multiple receivers at the same frequency, time, or phase, signals can be received as "interfering" signals—*i.e.*, a signal that suffers from interference from multiple users trying to use the same communications resource. Wireless communication technologies, such as the cellular technologies Time-Division Multiple Access ("TDMA"), Frequency Division Multiple Access ("FDMA") or Code-Division Multiple-Access ("CDMA"), incorporate technology for dividing the transmissions into multiple parts, each part dedicated to transmitting information for a different user. TDMA divides a transmission into various time slots, FDMA divides a transmission into different frequency ranges, and CDMA divides a transmission into

codes. Each of these techniques allow for more efficient use of bandwidth, but there is still interference from noise and between the multiple signals being transmitted over a single channel.

MUD techniques have been used since the 1980s to remove interference in a received signal by detecting a transmission signal's ***parameters*** *(e.g.*, phase, power, frequency, time delay) even if there are high levels of noise and interference. Conventional MUD typically compares the signal's detected parameters to at least a subset of known parameters for each user's signal to provide an estimate identifying the signal for each user, which is known as parameter estimating. Once the signal parameters are estimated, MUD separates the primary signal from the interfering signals.

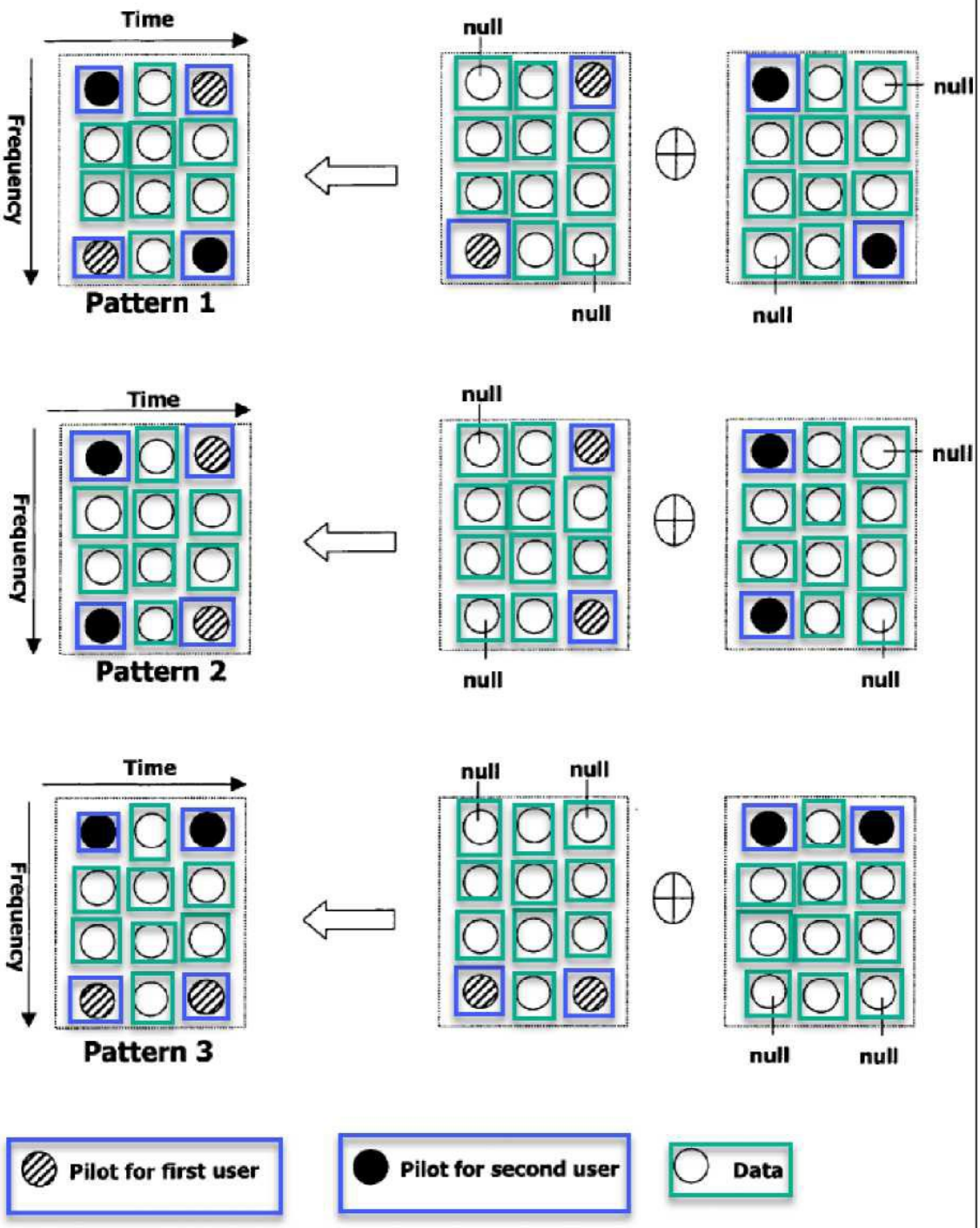
The '071 patent is directed to the basic concept of a method for enabling a node to distinguish information on a ***shared*** communication channel by using parameter-estimating signals transmitted on an ***unshared*** communication channel—*i.e.*, basic, well-known, MUD. The patent explains that shared channels are used for a wideband, high bit rate communication, while unshared data resources are narrow band and low bit rate, and are used for parameter-estimating signals.

The patent's purported improvement over the prior art is simple, and in truth is not inventive over the prior art: it transmits parameter-estimating information from

multiple devices on an ***unshared channel*** in a ***shared network*** while the prior art (as described by the '071 patent) purportedly only uses ***shared channels*** for all transmitted information. But the use of unshared channels, including in the context of MUD as described in the '071 patent, was well known at the time of the purported invention of the '071 patent, including in the prior art presented in this petition.

This petition presents two primary references: Jin (EX1004) and Baum (EX1005), both of which teach the MUD techniques claimed in the '071 patent. Jin is a 2005 LG patent application publication directed to "an uplink radio resource allocation in an OFDM/OFDMA system ... in which ... the same radio resource is allocated to user 1 and user 5" (*i.e.*, a shared data channel). EX1004, ¶56. Moreover, Jin teaches sending "pilot signals" on separate channels. EX1004, ¶72. Accordingly, Jin teaches the exact shared/unshared channel arrangement the '071 patent claims is inventive. For example, Figure 7A of Jin shows different channels, separated by frequency and time, wherein multiple users transmit data over shared "data" channels while pilot patterns for different users are transmitted on unshared channels to identify the data for each user. EX1004, Fig. 7A:

FIG. 7A


Time
Frequency
Pattern 1
null
null
null
null
Time
Frequency
Pattern 2
null
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

Baum is a 1999 Motorola patent that reduces the impact of interference in OFDM wireless communication systems by implementing a detector in a "receiver" that uses "joint detection." EX1005, 5:17-47, 18:1-8. This "joint detection" approach maps directly on the claims of the '071 patent. Baum also teaches using synchronization signals for estimating various parameters "based on a received signal containing known data such as the broadcast synchronization signal." EX1005, 9:27-33, 19:3-59. For example, Figure 5 shows different channels, separated by frequency and time, wherein multiple users transmit data over shared "data" channels while pilot codes for different users are transmitted on unshared channels to identify the data for each user. *Id.*, Fig. 5:

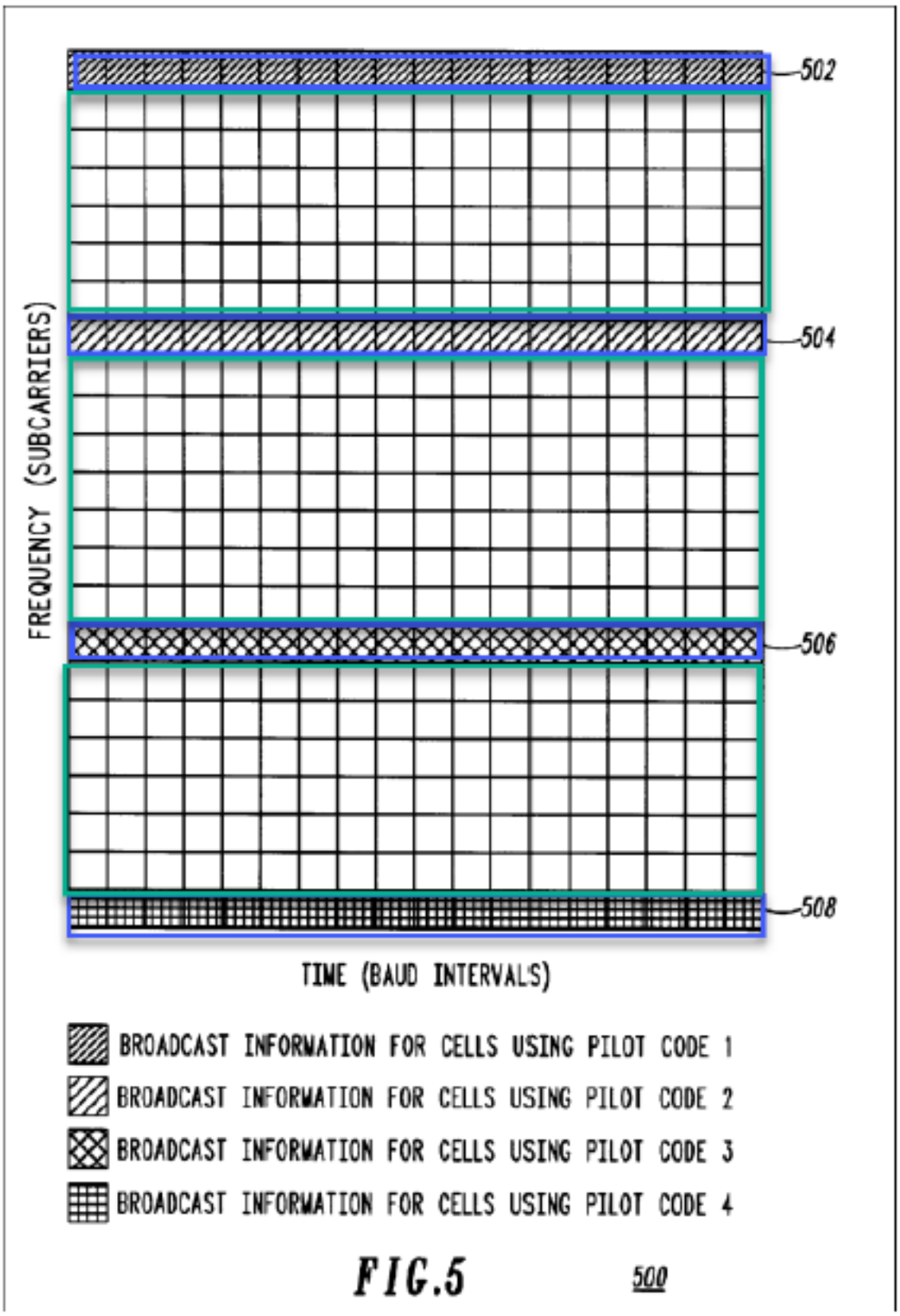

502
504
506
508
FREQUENCY (SUBCARRIERS)
TIME (BAUD INTERVALS)
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 1
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 2
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 3
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 4

FIG.5 500

The ’071 patent added nothing to this deep body of knowledge. The patent claims and describes the basic concepts of multi-user detection that were well known at the time.

II. STANDING

Petitioners certify the ’071 patent is available for *inter partes* review and they are not estopped.

III. GROUNDS[2]

Petitioners present five sets of Grounds based on Jin (Grounds 1-3) and Baum (Grounds 4-5). Grounds 1-3 rely on LG’s Jin patent application publication which, like the ’071 patent, discloses multi-user detection using a shared and unshared channels. Grounds 4-5 rely on Motorola’s Baum patent, which discloses multi-user detection where synchronization signals are sent over an unshared channel. In addition to the use of distinct and separate channels for carrying pilot symbols to mitigate interferences among the users in a cell taught by Jin, Baum specifically

[2] Petitioners are not aware of any secondary considerations of non-obviousness identified by Patent Owner, though none would rise to the level of overcoming the invalidity opinions of Dr. Min. EX1003, ¶¶ 189-193. Petitioners reserve the right to address any secondary considerations if raised by Patent Owner.

contemplates how to mitigate the interference from neighboring cells transmitting pilot symbols.

Ground	Basis	Reference(s)	Claims
1	§103	Jin	1-11, 16, 21
2	§103	Jin, Tsai	6-7
3	§103	Jin, Vrzic	8-9
4	§103	Baum	1-11, 16, 21
5	§103	Baum, Tsai	6-7

IV. POSITA

A POSITA at the time of the '071 patent had at least a bachelor's in EE/CE/CS, physics, or equivalent, and two years of experience with cellular telecommunications, radio-access network architectures, protocols and signal propagation in wireless networks. EX1003, ¶¶54-56. More education can supplement practical experience and vice versa. *Id.* Petitioners' expert exceeded this by the priority date. *Id.*

V. BACKGROUND

A. Technical Background

The '071 patent relates to multiuser detection ("MUD"). MUD techniques have been known for decades, and documented since at least the 1980s. EX1003,

¶¶33-45. Generally speaking, a MUD system allows users to transmit information over a shared communication path or channel. *Id.* The users' information is transmitted as interfering signals[3] over the shared communication path or channel. *Id.* As these signals are interfering, the receiver of the signals must differentiate the signals to correlate them with each user. MUD detects the signals for each user by demodulating the interfering signals using signal parameters *(e.g.*, signal phase, power, time delay, frequency, or code) related to each user. *Id.*

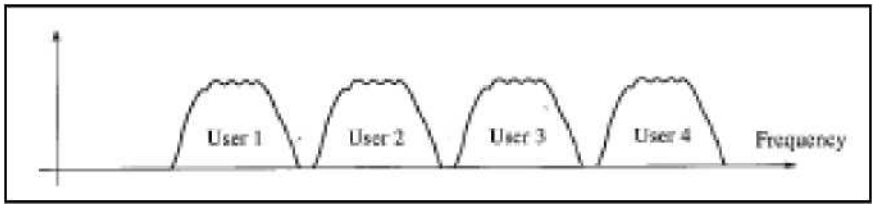
MUD is described by Sergio Verdu in "Computational Complexity of Optimum Multiuser Detection," Algorithmica (1989) (EX1009). EX1003, ¶35. In 1989, MUD was well known as detecting signals for each user in a multi-user system. For example, one implementation of MUD was described as "[t]he optimum multiuser receiver can be viewed as a bank of single-user detectors followed by a common algorithm that selects the most likely transmitted symbols." EX1009, 304.

[3] Interfering signals are signals that suffer from interference from another signal that overlaps in phase, frequency, time, or power. Interfering signals may include unwanted noise or intentionally overlapping signals from multiple sources. Interference in a received signal causes the primary signal's parameters to be obscured by the interfering signals.

MUD has been used in many familiar wireless technologies that require sending multiple user data streams over a single signal. EX1003, ¶36. Indeed, since the 1980s, multiuser detection has been implemented in cellular networks, satellite communication, high-speed data transmission lines, digital radio/television broadcasting, fixed wireless local loops, and multitrack magnetic recording. *Id.* All of these communication systems are subject to multiaccess interference and need a detector to determine the user for the data transmitted on the shared network. EX1008, xix; EX1003, ¶36.

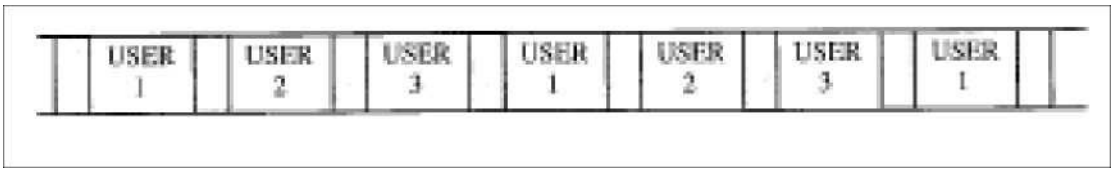
For example, Qualcomm pioneered the use of Code-Division Multiple-Access ("CDMA") technology in the 1990s. EX1003, ¶37. In the CDMA cellular networks, multi-user detection was implemented by modulating each user's transmitted signal using a signature waveform to identify the data that belonged to each user in the network. *Id*, EX1008, xix.

Another system pioneered by Qualcomm in the 1990s was Frequency Division Multiplexing or Frequency Division Multiple Access ("FDMA"). EX1003, ¶38. In FDMA systems, a different carrier frequency is assigned to each user in a network with a shared communication channel so that the resulting signals and spectra do not overlap. *Id*; EX1008, xix. This is shown below:



As shown in the above figure, each user has a signal parameter based on carrier frequency. EX1003, ¶39. The receiver can use this carrier frequency to demodulate the signal and correlate it to the user. *Id.*

Yet another system in use in the 1990s was Time Division Multiplexing ("TDMA") systems. EX1003, ¶40. In such systems, *time* is partitioned into slots assigned to each incoming digital stream in round-robin fashion and demultiplexing is carried out by simply switching on to the received signal at the appropriate times. *Id.* Time division can be used not only to multiplex collocated message sources but also by geographically separated users who have the ability to maintain time-synchronism. *Id.* This is shown below:



As shown in the above figure, each user has a signal parameter based on time division. *Id.*, ¶41. The receiver can use this time division to demodulate the signal and correlate it to the user. *Id.*

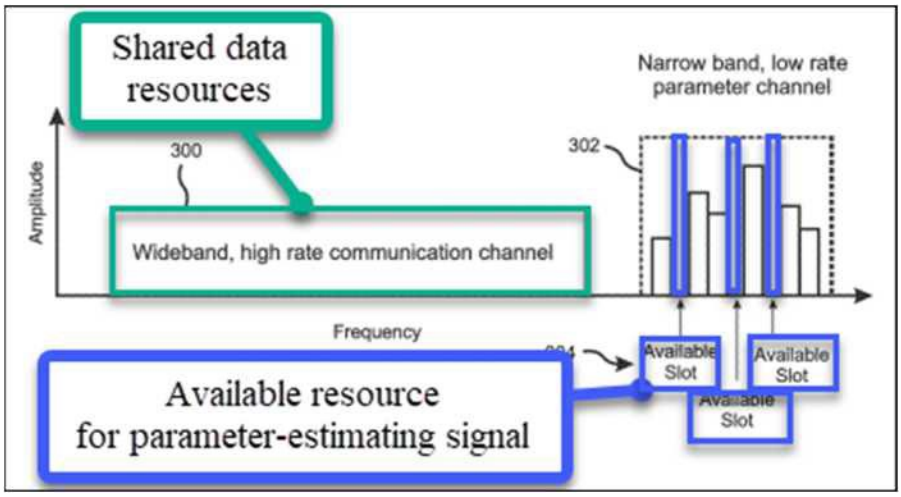
In the above CDMA, FDMA and TDMA systems, it was critical to correlate data streams to users. *Id*., ¶42. All of these systems employed MUD, and specifically, utilized parameters to identify the user that corresponds to the data sent over the shared channel. *Id.* All of these systems used signal processors that would identify the signal parameters to estimate the signal and separate the signal from the interfering signals. *Id.* Given bandwidth constraints, security concerns, and possible interference, it was well known in the 1990s to use an unshared channel to send the parameter information for the data. *Id.* For example, FDMA and TDMA were well-known multiplexing schemes that would provide parameters over a separate and distinct time or frequency so as not to overlap with the data. EX1009, 304; EX1003, ¶42. Solutions to the problem of sending parameter signals over the shared communication channel were well known at the time of the ’071 patent’s alleged invention. EX1003, ¶42.

B. ’071 Patent

The ’071 patent is directed to detecting data for users transmitted over a shared communication channel using signal parameters to distinguish transmitted user data. EX1001, 3:18-21, 3:26-29. As the ’071 patent admits, “spread spectrum” technologies such as TDMA and FDMA were known to “‘spread’ the shared communications medium into a plurality of separately usable communication

channels." *Id.*, 2:42-60. These separate communication channels could be used to send data for single user instead of being shared among all of the users. *Id.*

The '071 patent does not purport to invent MUD. Instead, the purported invention is the use of "an unshared, dedicated, low-collision or collision-free parameter channel, such as may be created using" FDMA or TDMA, to send signal parameters that can be used for detecting a user's signals. *Id.*, 3:45-49. In Figure 3, for example, FDMA is used to divide the frequency spectrum into "a main communication channel 300" (shared communication channel) and "a plurality of parameter channels 302" (unshared communication channel). *Id.*, 8:27-30.



Thus, the '071 purports to introduce a MUD system that uses an unshared channel to send parameters for the signals transmitted over the shared communication channel. Such systems, however, were already well known. EX1003, ¶45.

1. Original Prosecution History

The claims were initially rejected as anticipated by U.S. Patent Application Publication No. 2006/0114826 ("Brommer"). EX1002, 215-227. The Applicant responded by arguing that the "unshared" aspect of "unshared parameter channels" rendered the claims patentable over the prior art. *Id.*, 243-253. The Applicant argued, *inter alia*, "[t]he channel Brommer uses is clearly a single ***shared channel*** since the polling signals are transmitted 'simultaneously.' Brommer does not disclose (or suggest) 'detecting the parameter-estimating signals on the ***unshared parameter channels*** and estimating therefrom at least one unique signal parameter for each of the transmitting nodes,' as recited in claim 1," thus affirming the importance of the use of an unshared channel for parameter estimation signals to the claims. EX1002, 250 (emphasis added).

The Examiner maintained the rejections in the next office action. *Id.*, 259-277. The Applicant responded by filing an appeal brief arguing, as before, that "Brommer does not disclose transmitting on an unshared channel." *Id*., 294-312. The PTAB reversed the Examiner stating: "[w]e have reviewed the cited paragraphs of Brommer and do not agree with the Examiner that they disclose transmitting on an ***unshared*** channel, as required by claim 1" as Brommer only discloses "a single, ***shared*** communication channel for transmission of signals." *Id*., 343 (emphasis in

original). Thereafter, the Examiner issued a notice of allowance finding the claims allowable for the same reasons indicated by the PTAB. *Id*., 348.

2. IPR2022-01233

On July 20, 2022, Nokia Corp. ("Nokia") and Ericsson Inc. ("Ericsson") filed a petition for IPR challenging 1-10, 13, 14, 16, and 21 of the '071 patent. EX1010, 8. In the petition, Nokia and Ericsson asserted the following invalidity grounds:

Claims	Prior Art Combination Under 35 U.S.C. § 103
1-3, 5-7, 13, 14, 16, 21	U.S. Patent Pub. 2008/0032630 ("Kim")
1-5, 10, 16, 21	U.S. Patent Pub. No. 2004/0114618 ("Tong") combined with U.S. Patent Pub. No. 2004/0066866 ("Jia")
6, 7	Tong combined with Jia and U.S. Patent No. 7,778,337 ("Zhu")
13, 14	Tong combined with Jia, Zhu, and U.S. Patent No. 7,486,735 ("Dubuc")
1, 4, 8-10	U.S. Patent No. 5,867,478 ("Baum")

On January 19, 2023, the Board denied the petition pursuant to 35 U.S.C. §314(a) because of the advanced stage of the co-pending district court litigation. EX1012, 10-19. In addressing the merits of the petition, the Board also found that the petition's "Baum-based challenge relies on different embodiments of Baum without providing sufficiently persuasive evidence that the different embodiments

would apply to one another." *Id.*, 18. The Board did not otherwise analyze the various Baum embodiments on the merits, and thus did not provide a "roadmap" for the use of Baum.

This Petition presents grounds and arguments different from those presented in the '1233 Petition. The Jin, Tsai, and Vrzic references relied upon in Grounds 1-3 and 5 were not presented in the '1233 petition and are not cumulative of those references. Although Baum was presented in the '1233 petition, this Petition explains how the relevant disclosures in Baum regarding joint detection apply to ***all*** of the embodiments. For example, Baum discloses using joint detection with the detection scheme in all of the embodiments because "diversity reception [like that disclosed in Figs. 5 and 6] is still beneficial even when joint detection is employed." EX1005, 18:6-8. Baum further explains that "joint detection" is "referred to as multi-user detection," and all of the embodiments in Baum use multi-user detection because they transmit interfering signals for multiple base stations over the same shared channels. *Id*., 5:17-47, 18:1-8. Accordingly, even the Baum-based grounds in this Petition does not suffer from the same defect the Board identified in the '1233 petition.

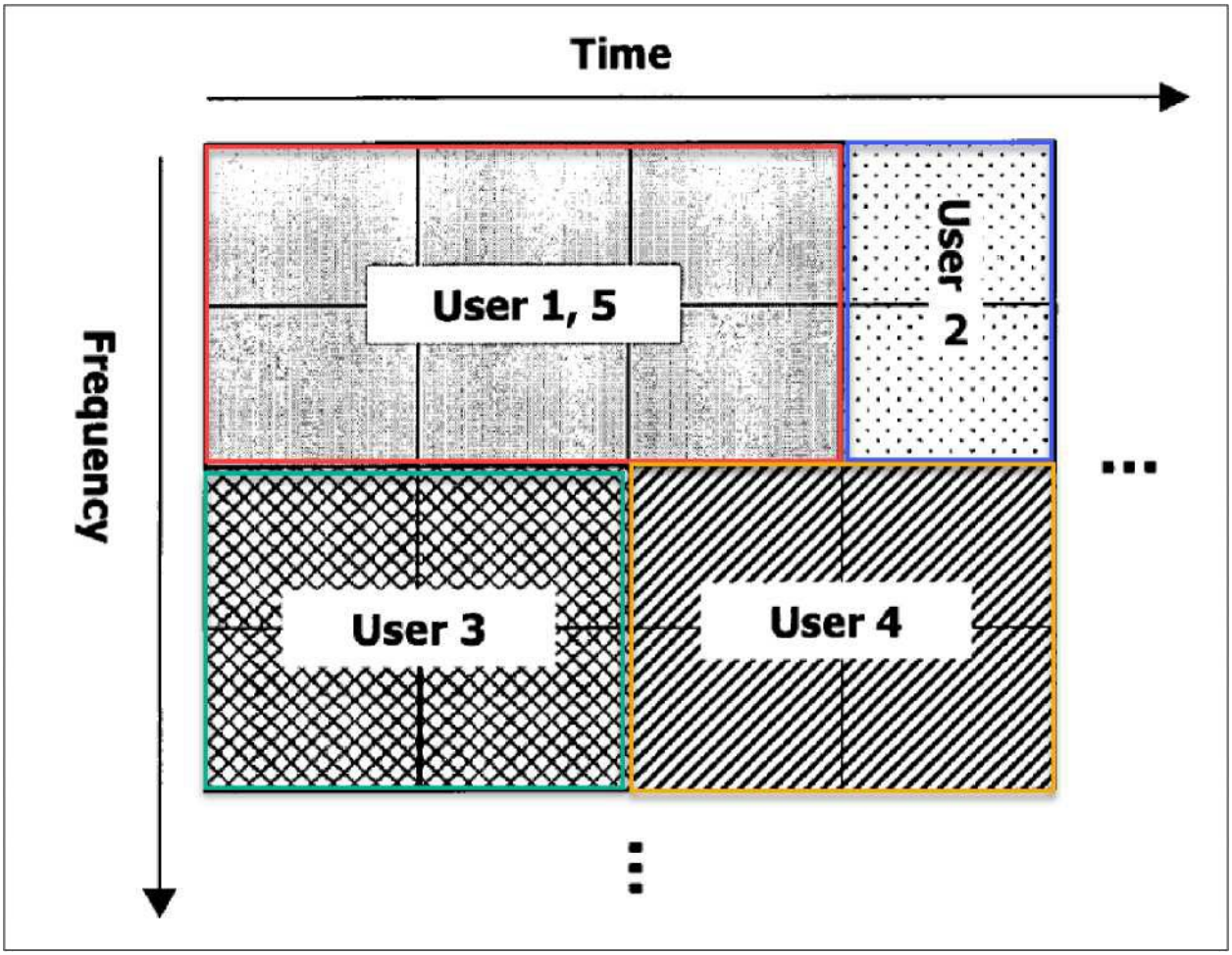
3. Claim Construction

For purposes of this Petition only, Petitioner does not believe any terms require a formal construction. Each of the terms carries its "ordinary and customary meaning," which is "the meaning that the term would have to a person of ordinary skill in the art in question" at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (citation omitted); EX1003, ¶¶57-58.

C. Prior Art

1. Jin (EX1004)

Jin discloses a multi-user detection system wherein two users *(e.g.*, users 1 and 5 shown in Figure 5, annotated below) are transmitting on the same shared channel in an OFDM (Orthogonal Frequency Division Multiplexing) wireless network. EX1004, Fig. 5:

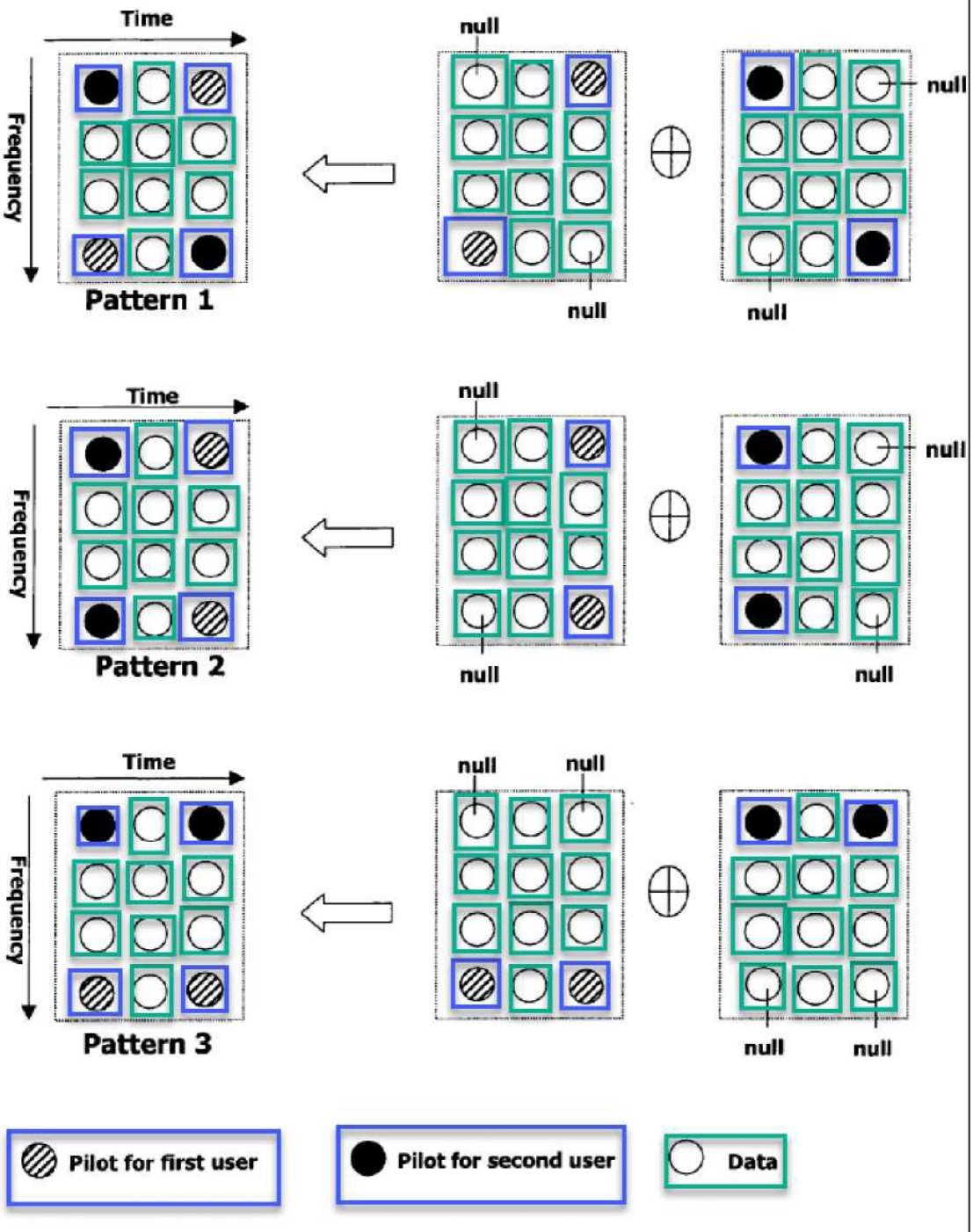


In an OFDM network, a single data stream is split among several closely spaced narrowband subchannel frequencies instead of a single wideband channel frequency. EX1003, ¶61. The subchannel frequencies can be shared with other users or unshared depending on the allocation of the frequency and time. *Id.*

Jin discloses identifying the data for two users *(e.g.*, user 1 and user 5) by using signal parameters that are sent on an unshared communication channel. For example, Jin discloses "analyz[ing] a pilot pattern of the basic allocation unit

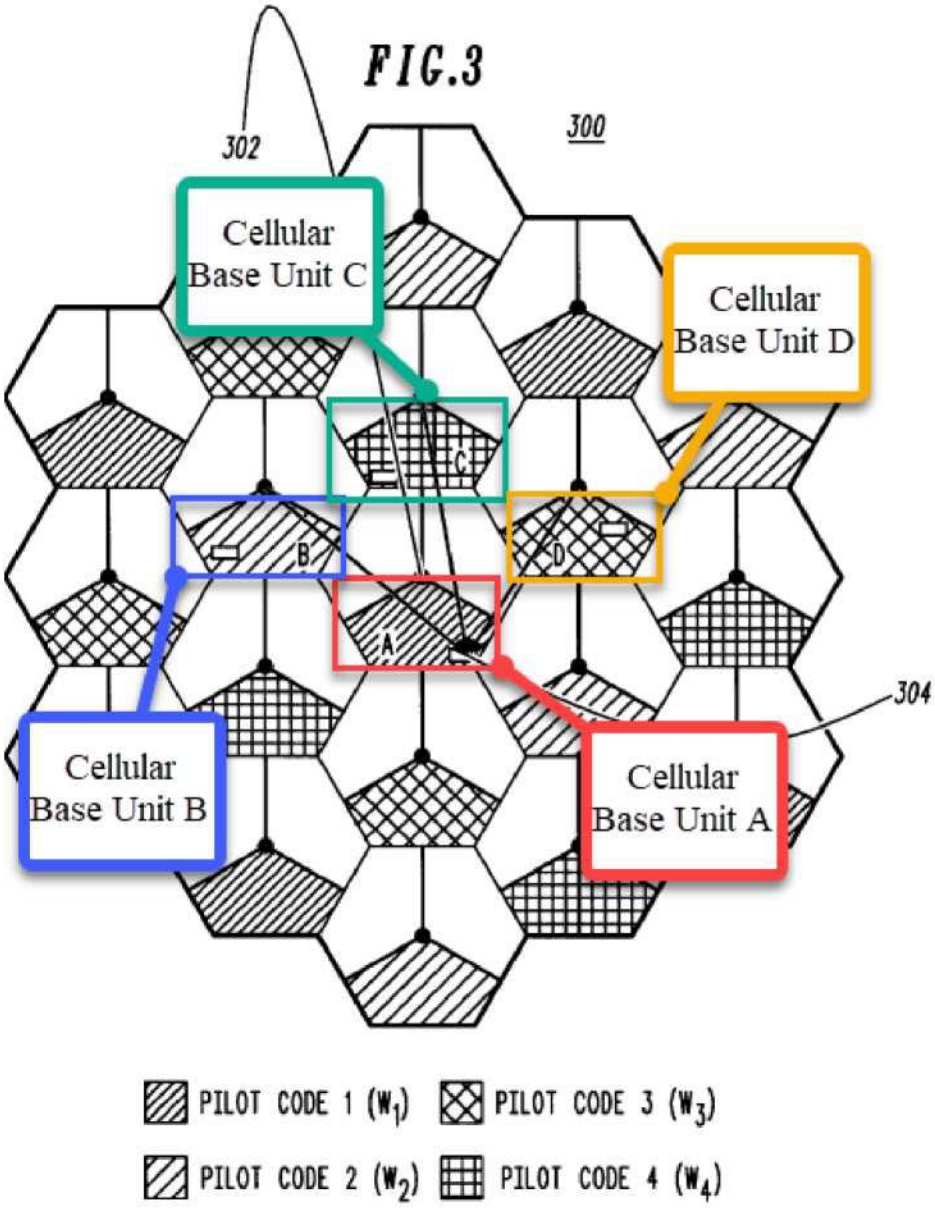
received over the uplink to identify which user (*i.e.*, mobile terminal) has transmittedthe received data [by] ... identifying] whether the received data is from user 1 or user 5 by analyzing the pilot pattern included in the basic allocation unit." EX1004, 56, 72. The pilot patterns are transmitted on different channels from the data, as illustrated in Figure 7A (annotated below):

FIG. 7A

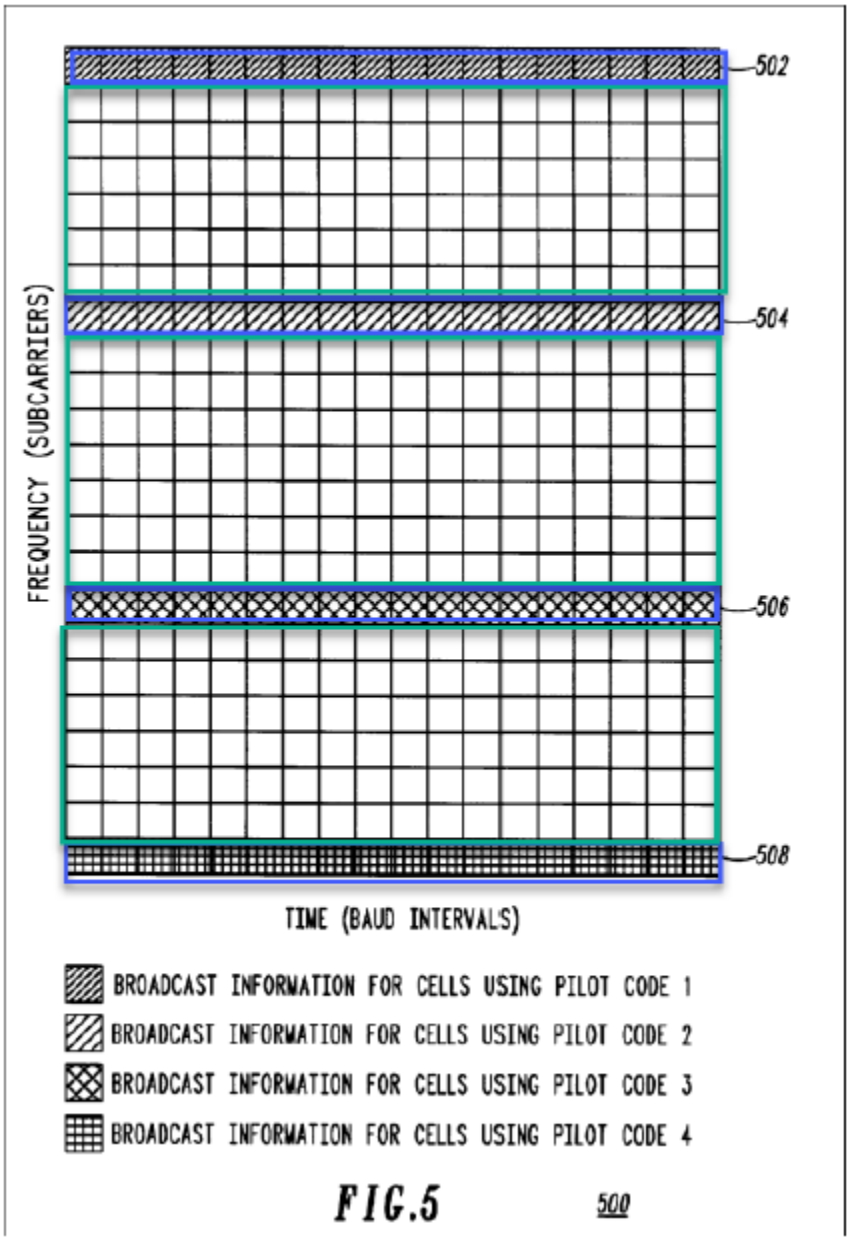

Time
Frequency
Pattern 1
null
null
null
Time
Frequency
Pattern 2
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

2. Baum (EX1005)

Baum discloses a multi-user detection system and method. EX1005, 5:17-47, 18:1-8. Baum discloses a cellular network with four base units in different sectors (A, B, C, and D in the annotated version of Figure 3 below), each of which transmits over a shared and unshared communication channel.



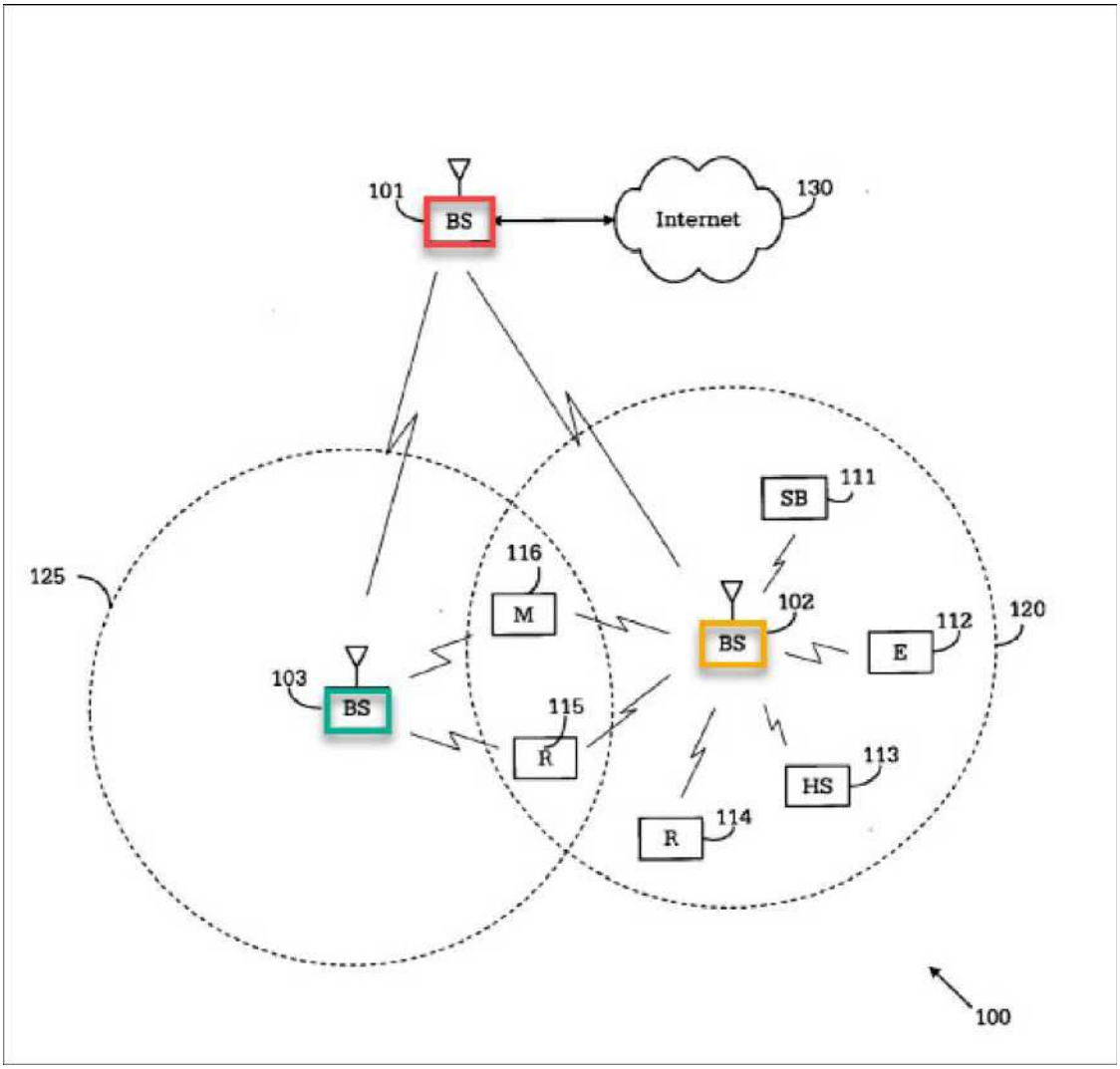
Baum discloses a synchronization signal sent on the unshared channel for identifying the user for the data that is sent on the shared channel, as illustrated in Figure 5 (annotated below):



3. Tsai (EX1006)

Tsai discloses a multi-user detection system and method where multiple base stations transmit data over shared and unshared communication channels. EX1006,

¶¶30-33. Tsai shows an exemplary network with base stations BS 101, BS 102, and BS 103 as shown in Figure 1 (annotated below):



Tsai's system is a multiple-input multiple-output ("MIMO") system. EX1006, ¶52. In a MIMO system, the multiple inputs and multiple outputs can include data from multiple users transmitted as co-channel interfering signals, and "MIMO channel estimation" is used to determine the identity of the user or base

station that transmitted the data which "consists of estimating the channel gain and phase information" to differentiate signals from different users or base stations. EX1006, ¶52.

4. Vrzic (EX1007)

Vrzic discloses a multi-user detection system and method where multiple base stations transmit data over shared and unshared communication channels. EX1007, ¶21. Figure 1, annotated below, shows an exemplary network with base stations BS 16, BS 16, and BS 16.

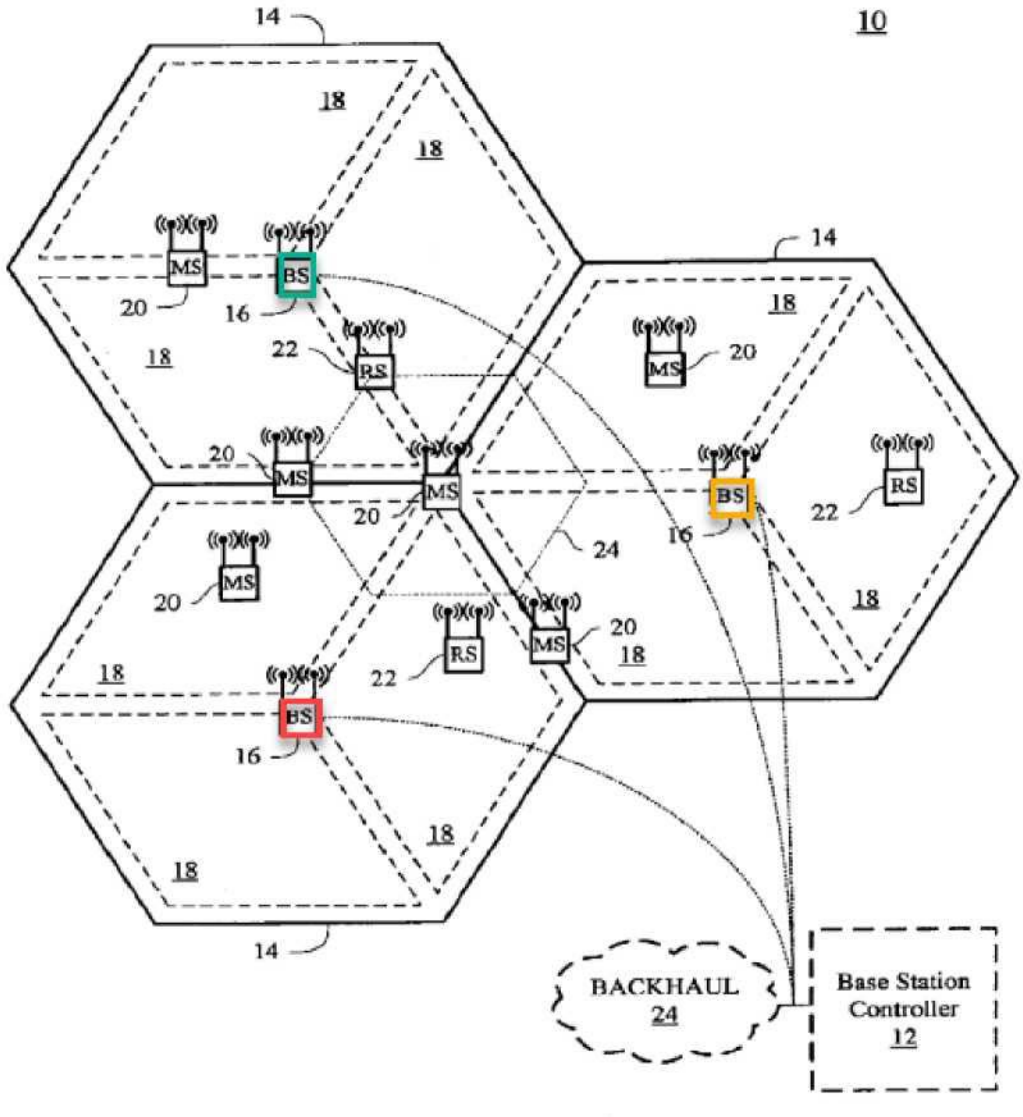


FIG. 1

Vrzic's system is a MIMO system and uses "synchronization logic" to identify the user for the data transmitted over the shared communication channel using "frequency offset and clock estimation logic 106, which is based on the headers to help estimate such effects on the transmitted signal and provide those estimations to

the correction logic 104 to properly process OFDM symbols" to differentiate signals from different users. EX1007, ¶41.

VI. CLAIMS 1-11, 16, AND 21 ARE UNPATENTABLE

A. Ground 1: Claims 1-11, 16, 21 are Rendered Obvious by Jin

Jin renders obvious claims 1-11, 16, and 21. EX1003, ¶¶73-117.

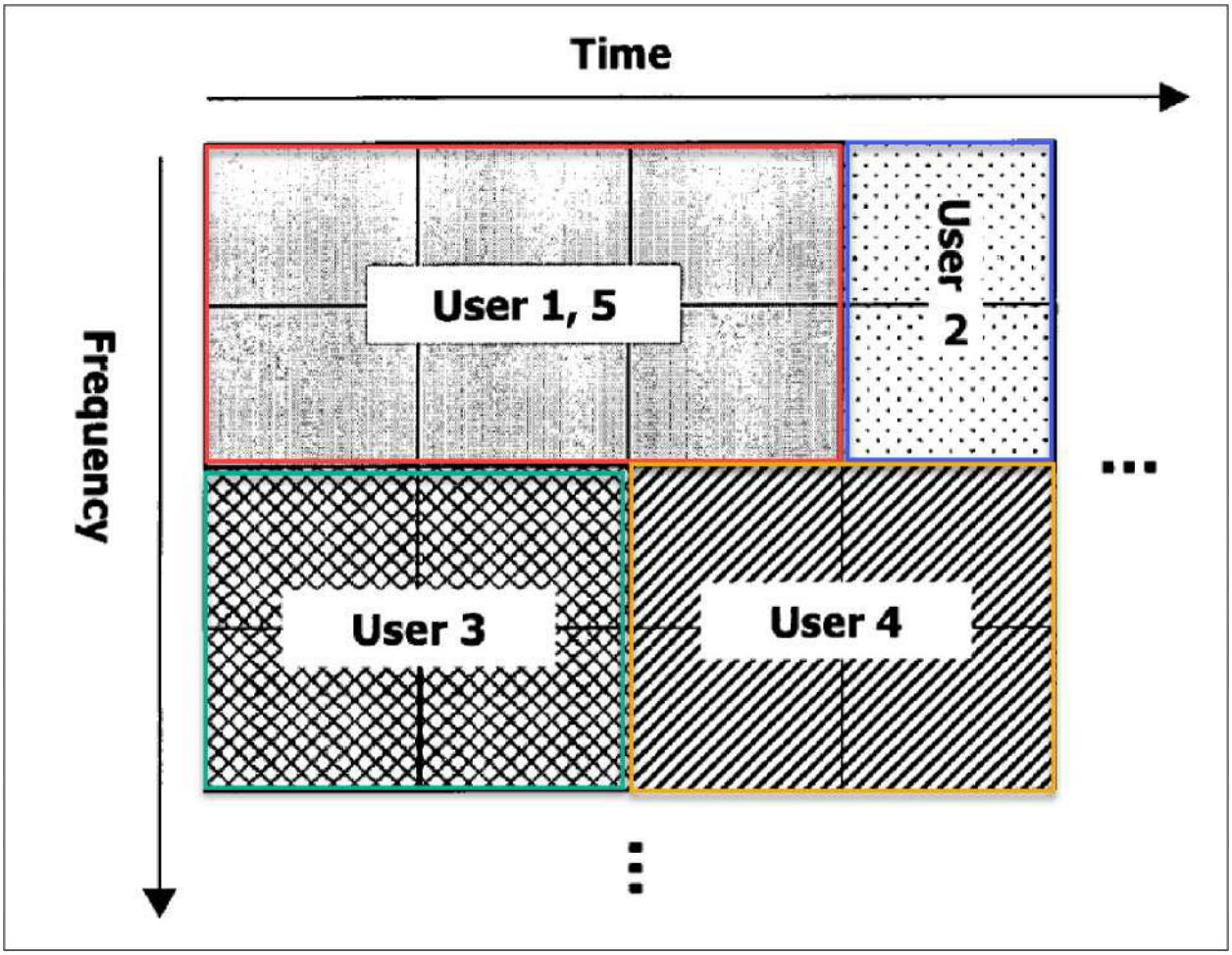
1. 1pre:

To the extent the preamble is limiting, Jin discloses it. *Id.*, ¶¶74-80.

A Method for Enabling a Receiving Node to Distinguish Information Simultaneously Received: Jin's base station *(i.e.*, "**receiving node**") receives information simultaneously transmitted from two mobile terminals *(e.g.*, user 1 and 5) and "analyzes a pilot pattern of the basic allocation unit received over the uplink to identify which user *(i.e.*, mobile terminal) has transmitted the received data [by] ... identifying] whether the received data is from user 1 or user 5 by analyzing the pilot pattern included in the basic allocation unit" (*i.e.*, "**distinguish information simultaneously received**"). EX1004, ¶32, 56, 72; EX1003, ¶75. As the receiver is receiving the data from multiple users at the same time, it uses the pilot patterns to distinguish the information for each user. EX1003, ¶75.

From A Plurality of Transmitting Nodes: Jin discloses a wireless communication network with at least five mobile terminals, one for each user, which

are transmitting *(i.e.*, **"a plurality of transmitting nodes**") as shown in Fig. 5 (annotated below). *Id*., ¶¶76-77.



Transmitting ... on a Shared Communication Channel: The mobile terminals for user 1 and 5 are transmitting on the same channel *(i.e.*, "**shared communication channel**") as "the same radio resource is allocated to user 1 and user 5." EX1004, 32, 56; EX1003, ¶78. Jin's same radio resource allocation disclosure is the same as Patent Owner's mapping in its infringement contentions in

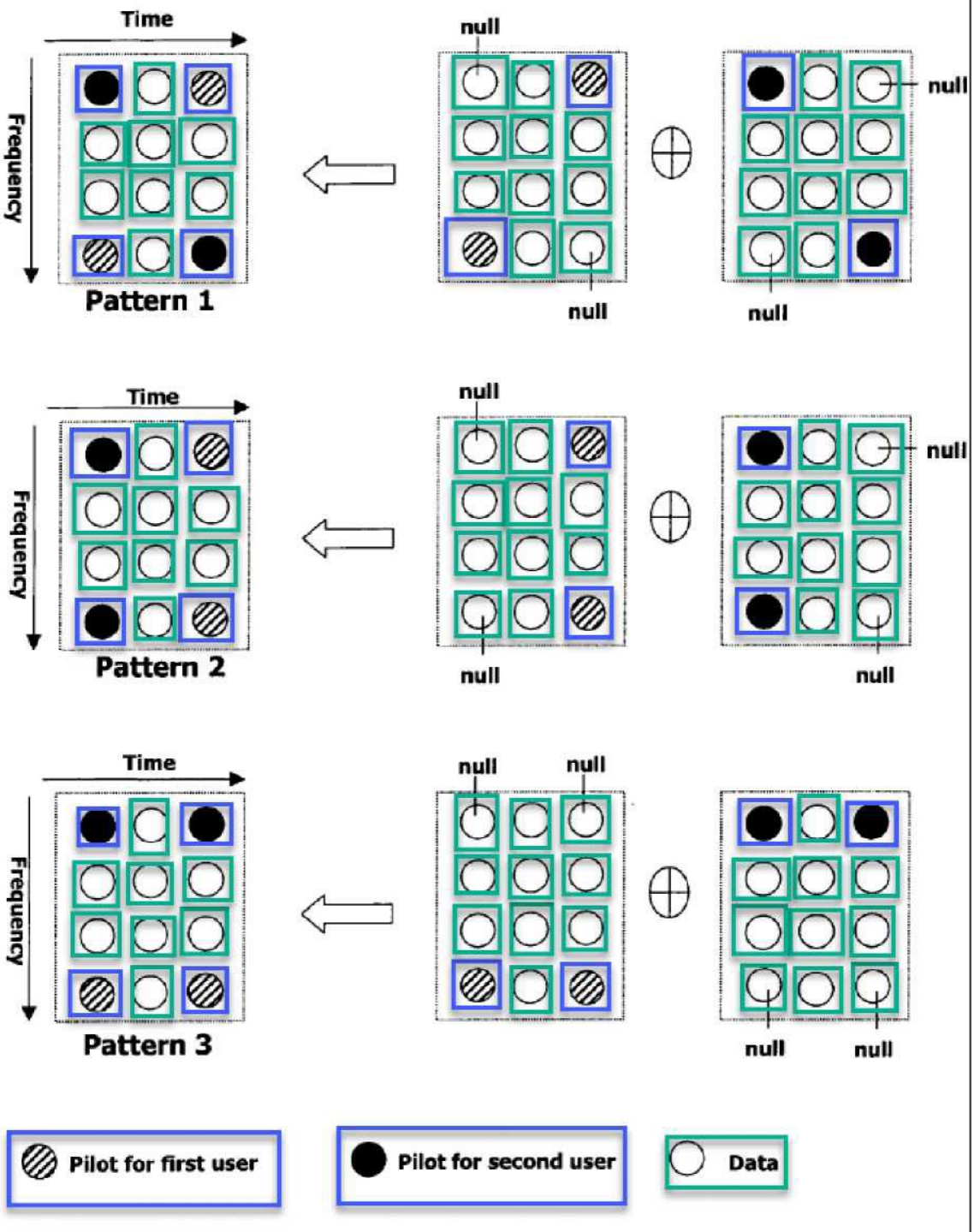
the district court litigation, as Patent Owner has mapped the shared communication channel to the data portion of a frame. EX1013, 25; EX1003, ¶79.

Of a Wireless Digital Network: Jin discloses "a wireless communication system" that uses digital modulation as it is "an OFDM/OFDMA system" ("**wireless digital network**"). EX1004, ¶32, 56; EX1003, ¶80.

(a) 1a

Jin discloses "pilots" that are unique for each user device and are sent on an unshared "subcarrier or subchannel" *(i.e.*, "**plurality of parameter channels on the network**"). EX1004, ¶¶73-76; EX1003, ¶82. The pilots occupy different regions of time and/or frequency in a frame (*i.e.*, are "**in addition to the shared communication channel**"), which allows the base station to measure or monitor each synchronization signal without co-channel interference. *Id.* Jin discloses that "[i]n patterns 1, 2, and 3 as shown in FIG. 7A, ***user 1 and user 5 use different pilots***, respectively, and thus, the ***data of the two users can be identified***" EX1004, ¶ 74; EX1003, ¶82. In Fig. 7A, Jin discloses precise positions of the pilot signals for each user, together making up a pilot subcarrier channel (*i.e.*, **"parameter channel")** and the data is sent on the "shared communication channel". EX1003, ¶82.

FIG. 7A


Time
Frequency
Pattern 1
null
null
null
Time
Frequency
Pattern 2
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

The pilots in Jin are used to estimate parameters as the base station uses the pilots to "measur[e] the radio channel for each user and compensate] the channel, and applies it to a method for dividing data of users." EX1004, ¶ 78; EX1003, ¶83. Jin's disclosure of the plurality of parameter channels is further supported by Patent Owner's infringement contentions in the district court litigation, as Patent Owner has mapped the plurality of parameter channels to different frequencies or times for transmitting different user's parameter. EX1013, 25; EX1003, ¶83.

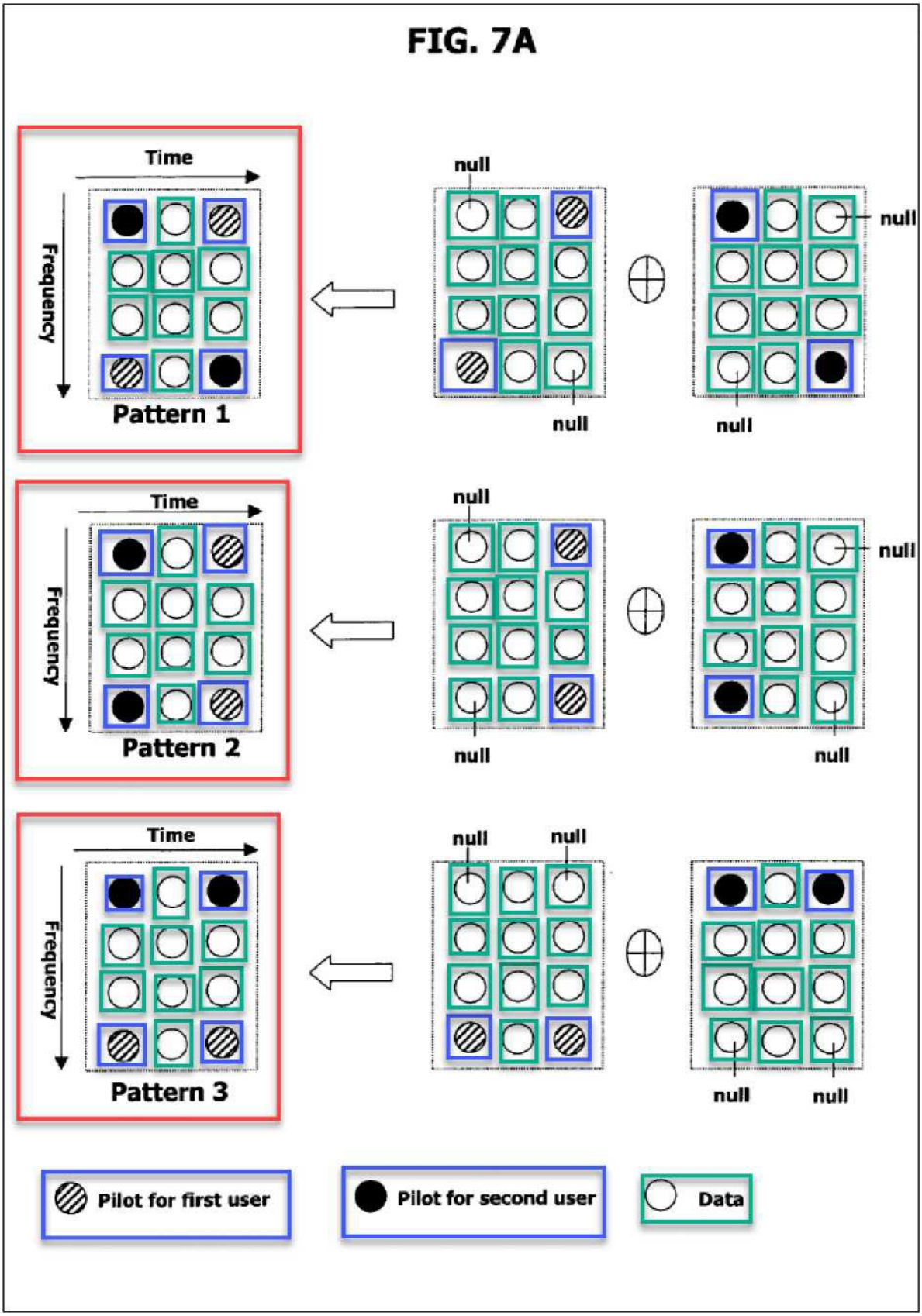
(b) 1b

Jin discloses that each mobile terminal is a user *(i.e.* "**transmitting node**") and in order to differentiate multiple mobile terminals, for example, two different mobile terminals are each required to transmit a unique pilot pattern to use the "different pilot patterns ... for identifying signals delivered from two mobile terminals" *(i.e.* "**parameter-estimating signal**"). EX1004, ¶¶73-76, 86, Fig. 7A; EX1003, ¶85. Thus, Jin discloses that each transmitting node is required to transmit parameter-estimating signals. In particular, Jin discloses the pilot pattern signals are received by the base station from the mobile terminals, and "[t]he base station analyzes a pilot pattern of the basic allocation unit received over the uplink to identify which user (*i.e.*, mobile terminal) has transmitted the received data." EX1004, ¶72; EX1003, ¶85. Pilot patterns in Jin are used to estimate parameters as

the base station uses pilot patterns for estimating phase differences and "measuring the radio channel for each user and compensating the channel, and applies it to a method for dividing data of users." EX1004, ¶¶77,78; EX1003, ¶85.

This can be seen in Fig. 7A, where the pilot patterns are transmitted on the unshared "parameter channels". EX1003, ¶86.

FIG. 7A


Time
Frequency
Pattern 1
null
null
null
Time
Frequency
Pattern 2
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

(c) 1c

Detecting the Parameter-Estimating Signals on the Unshared Parameter Channels: Jin discloses each mobile terminal uses distinct sets of time and frequency positions for transmitting pilots so the pilot patterns *(i.e.*, "**parameter-estimating signals**") are detected on the pilot subchannels where different pilot subchannels correspond to a different user (*i.e.*, "**unshared parameter channels**"). EX1004, ¶¶73-76, Fig. 7A; EX1003, ¶88. Jin discloses the pilot pattern is received by the base station from the mobile terminals and "[t]he base station analyzes a pilot pattern of the basic allocation unit received over the uplink to identify which user (*i.e.*, mobile terminal) has transmitted the received data." EX1004, ¶72; EX1003, ¶88. The base station in Jin detects the pilot patterns, as it receives them on the unshared pilot subchannels and then uses the pilot patterns to identify the data for each user. *Id.*

Estimating ... at Least One Unique Signal Parameter for Each of the Transmitting Nodes: Jin discloses estimating at least one unique signal parameter for each user *(i.e.*, "**transmitting node**"). EX1004, ¶¶73-76, Fig. 7A; EX1003, ¶89. Jin discloses the base station uses the received pilot pattern signal to "identify which user (*i.e.*, mobile terminal) has transmitted the received data" by estimating phase differences and "measuring the radio channel for each user and compensating the

channel, and applies it to a method for dividing data of users." EX1004, ¶¶72, 78; EX1003, ¶89. The phase differences and radio channel parameters are **unique signal parameters.** *Id.*

(d) 1d

Jin discloses the data *(i.e.*, "**information**") from each user *(i.e.* , "**transmitting node**") is detected and distinguished when received by the base station by "analyz[ing] a pilot pattern of the basic allocation unit received ... to identify which user (*i.e.*, mobile terminal) has transmitted the received data." EX1004, ¶72, 74; EX1003, ¶91. The data is received simultaneously (*i.e.*, "**information simultaneously received**") from each user, as Jin discloses "simultaneous allocation" of the channel for transmitting the data from each user and the "mobile terminals to simultaneously use a radio resource allocated to one mobile terminal." EX1004, ¶¶55, 78; EX1003, ¶91. Jin discloses that the base station uses the unique pilot parameter (*i.e.*, "**unique estimated signal parameters**") to "identify which user (*i.e.*, mobile terminal) has transmitted the received data" (*i.e.*, "**detecting and distinguishing"**) by estimating phase differences and "measuring the radio channel for each user and compensating the channel, and applies it to a method for dividing data of users." EX1004, ¶¶72, 78; EX1003, ¶91.

2. Claim 2

Jin discloses using channel-spreading technology, like time division and frequency division (*i.e.*, "**channel-spreading technology**"), to provide a plurality of pilot subchannels *(i.e.*, "**parameter channels**"). EX1004, ¶75; EX1003, ¶93. Jin's disclosure of time division and frequency division is consistent with the '071 patent's characterization of "time division" and "frequency division" as channel-spreading technology. EX1001, 2:42-60.

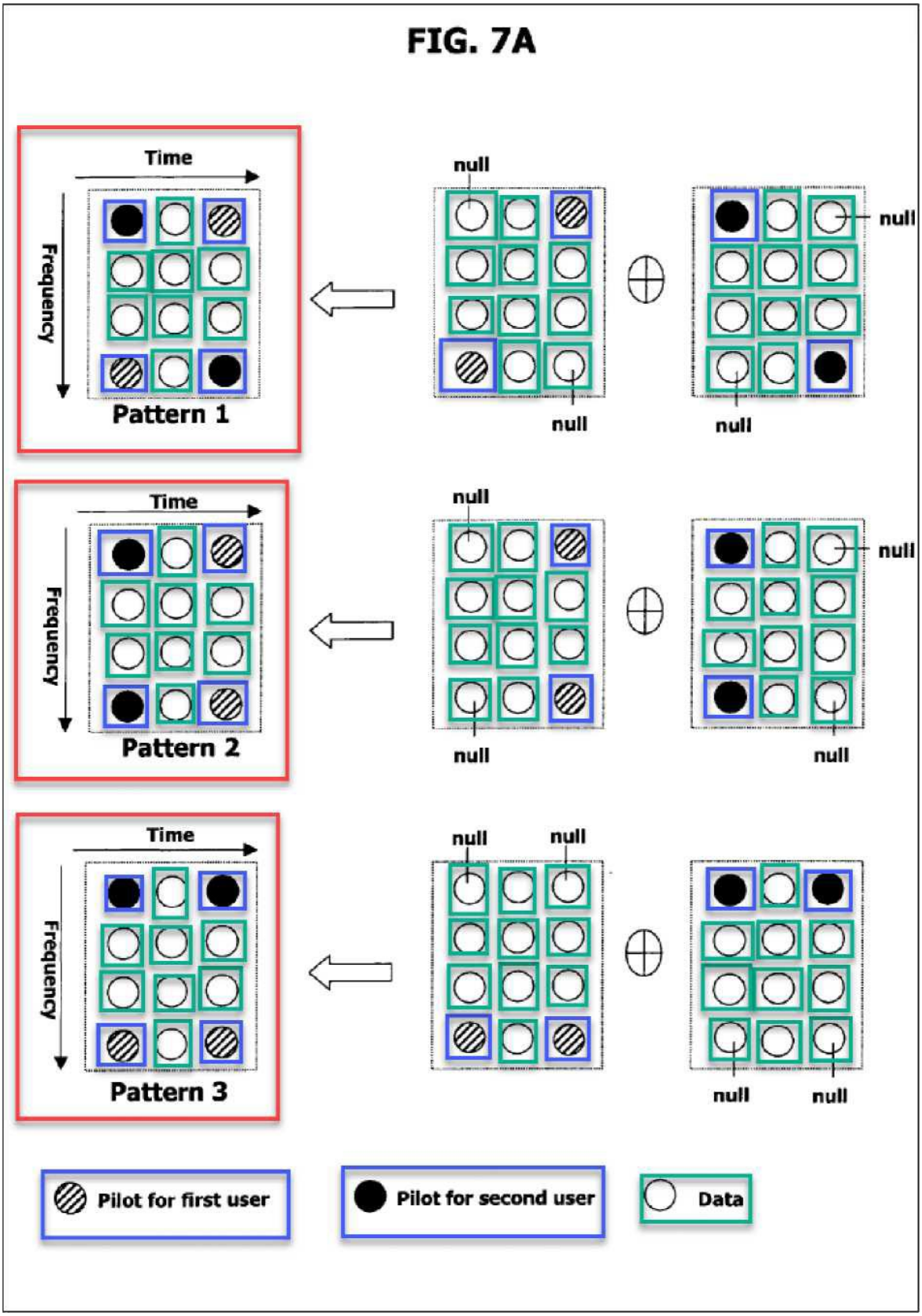
3. Claim 3

Jin discloses this claim. EX1003, ¶¶94-95. Jin discloses using time division ("**TDMA**") and frequency division ("**FDMA**") to provide a plurality of parameter channels. *Id.;* EX1004, ¶¶73-75.

4. Claim 4

Jin discloses each user (*i.e.*, "**transmitting node**") transmits the pilot pattern (*i.e.*, "**parameter-estimating signal**") while **simultaneously transmitting** data (*i.e.*, "**information**") on the data subcarriers (*i.e.*, "**shared communication channel**"). EX1004, ¶72; EX1003, ¶97. Jin discloses "simultaneous allocation" of the channel for transmitting the data and pilot pattern and the "mobile terminals ... simultaneously use a radio resource allocated to one mobile terminal." EX1004, ¶55, 78. This is shown in Fig. 7A, where the data and the pilot pattern are transmitted simultaneously:

FIG. 7A


Time
Frequency
Pattern 1
null
null
null
Time
Frequency
Pattern 2
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

5. Claim 5

Jin discloses that in a conventional OFDM/OFDMA radio communication system, a horizontal axis indicates time by a symbol unit, while the vertical axis indicates frequency by a subchannel unit. EX1004, ¶7. This means that each of the time and frequency positions in an OFDM/OFDMA frame disclosed in Jin carries a symbol, which is a signal carrying one or more bits of information. EX1003, ¶99. As such, Jin's pilots *(i.e.*, "**parameter-estimating signal**"), each occupying one symbol time unit and one frequency subchannel, form a ***symbol pattern*** that is used for ***parameter estimation*** (*i.e.*, "**a parameter-estimating symbol pattern**") because the pilot patterns are used "to identify which user (*i.e.*, mobile terminal) has transmitted the received data ... by ***analyzing the pilot pattern*** included in the basic allocation unit." EX1004, ¶72; EX1003, ¶99. Additionally, Fig. 7A shows the pilot pattern as a symbol pattern:

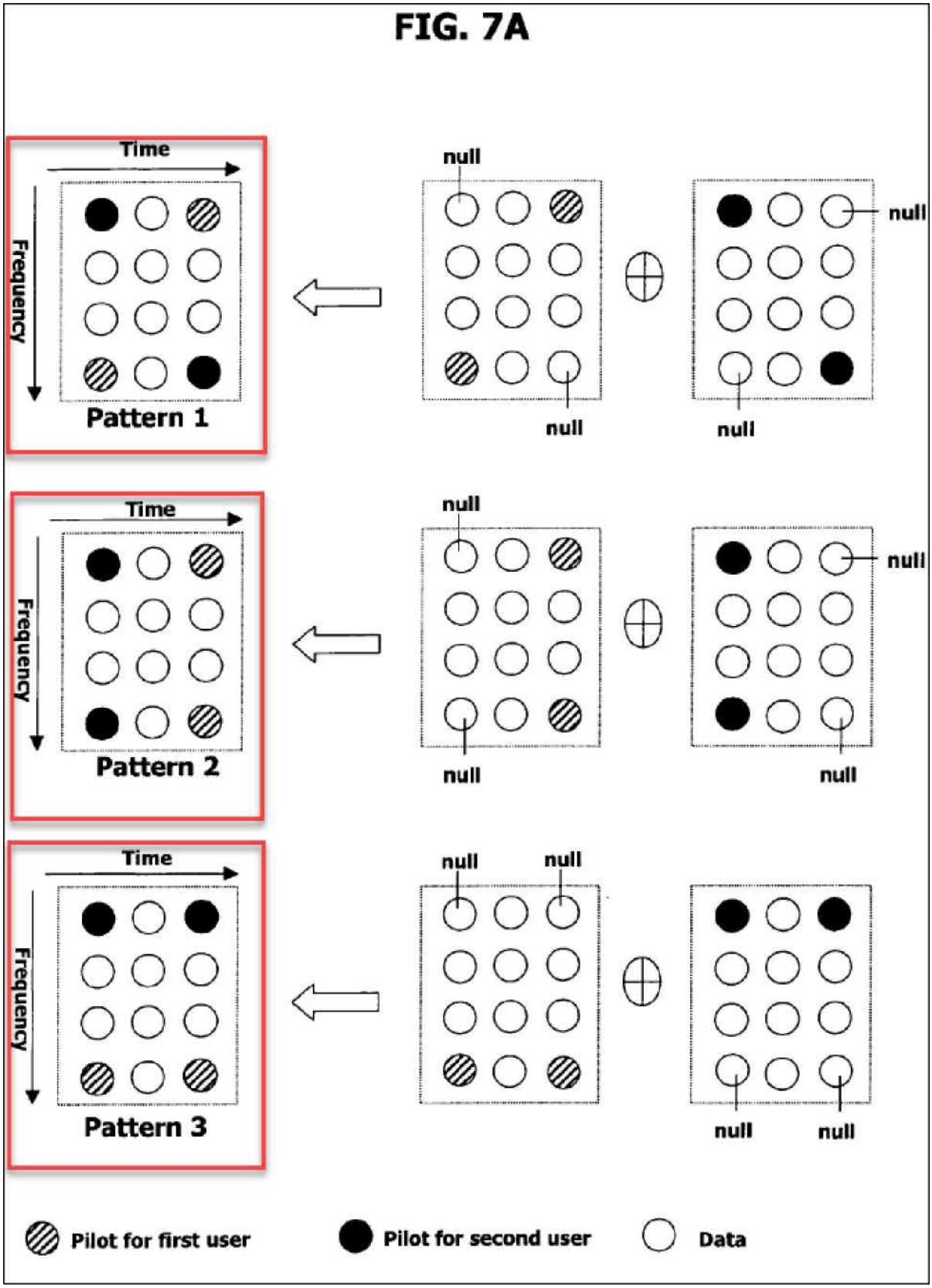


FIG. 7A
Time
Frequency
Pattern 1
null
null
null
Time
Frequency
Pattern 2
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

6. Claim 6

Jin discloses the use of different signal parameters to identify the user for the data transmission, including amplitude *(i.e.*, "**signal amplitude**"). EX1004, ¶77; EX1003, ¶101. Jin discloses that the base station uses the pilot signal amplitude value as a unique pilot parameter (*i.e.*, "**unique signal parameter**"). *Id.*

7. Claim 7

Jin discloses the use of different signal parameters to identify the user for the data transmission, including phase (*i.e.*, "**signal phase**"). EX1004, ¶77; EX1003, ¶103. Jin discloses that the base station uses the pilot signal phase and phase shift as a unique pilot parameter (*i.e.*, "**unique signal parameter**"). *Id.*

8. Claim 8

Jin discloses the use of different signal parameters to identify the user for the data transmission, including a carrier frequency offset (*i.e.*, "**signal carrier frequency offset**"). EX1004, ¶¶70, 75; EX1003, ¶105. Jin discloses that the base station uses the signal frequency and the offset of a frequency in the pilot signal as a unique pilot parameter (*i.e.*, "**unique signal parameter**"). *Id.*

9. Claim 9

Jin discloses the use of different signal parameters to identify the user for the data transmission, including relative time delay (*i.e.*, "**signal relative time delay**"). EX1004, ¶¶70, 75; EX1003, ¶107. Jin discloses that the base station uses the signal

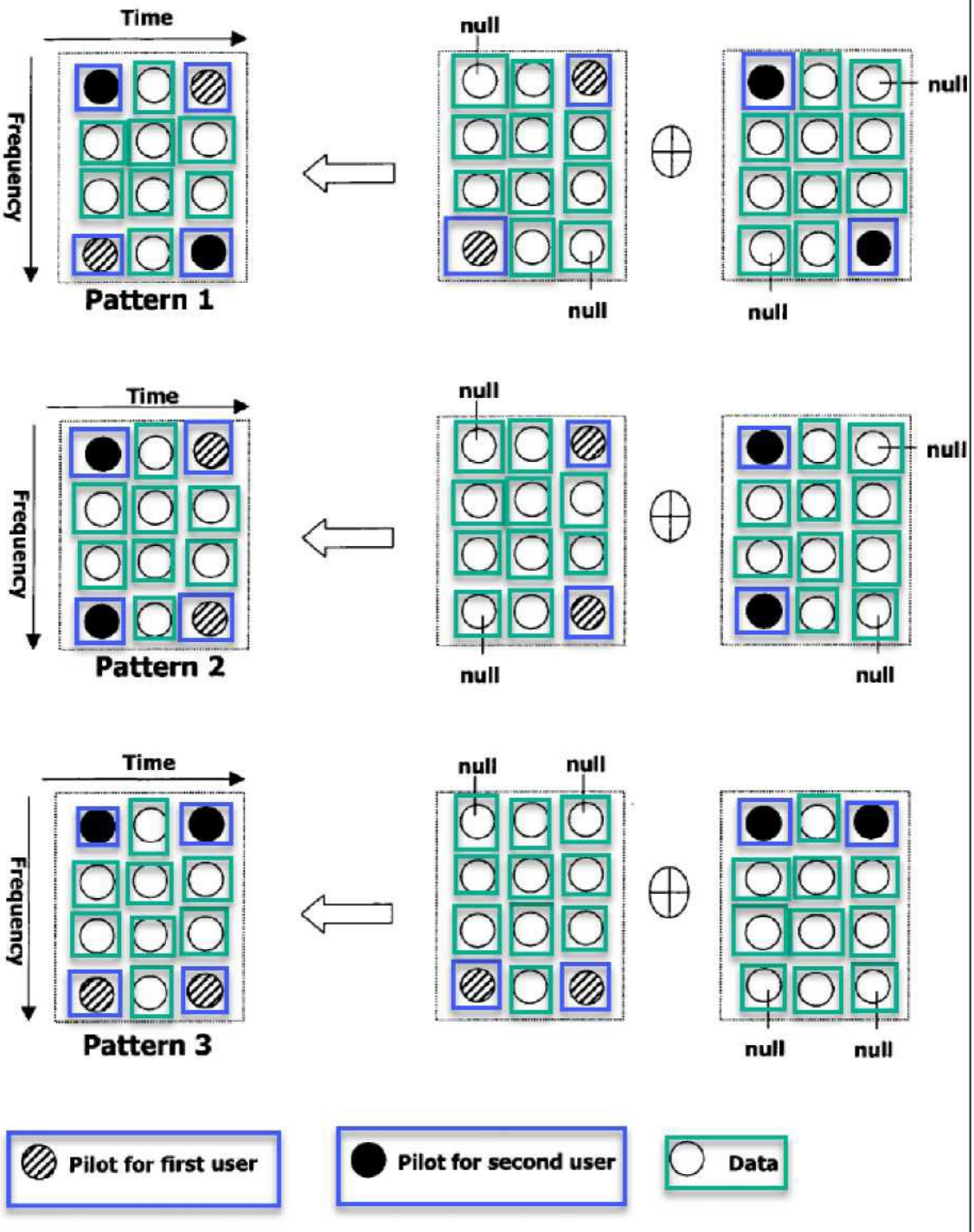
time and the delay in the signal time as a unique pilot parameter *(i.e.*, "**unique signal parameter**"). *Id.*

10. Claim 10

Jin discloses requiring each user (*i.e.*, "**transmitting node**") to transmit user identifying information (*i.e.*, "**node identifying information**") on the pilot subcarrier channel (*i.e.*, "**unshared parameter channel**"). EX1003, ¶109. Jin discloses transmitting user identifying information so as to detect and distinguish users by "analyz[ing] a pilot pattern of the basic allocation unit received ... to identify which user (*i.e.*, mobile terminal) has transmitted the received data." EX1004, ¶¶72, 74. In Jin, different users transmit their respective pilot signals at different time and frequency positions, as well as using different pilot signals. *Id.* The receiver, *i.e.*, the base station, estimates the parameters defining the channel conditions and also determines which user has transmitted the pilot signal. *Id.* Accordingly, the pilot signal comprises user identifying information as it is used "for measuring the radio channel for each user and compensating the channel, and applies it to a method for dividing data of users. In addition, data for each user can be divided and detected by applying a radio channel of each user." EX1004, ¶78; EX1003, ¶109.

In Fig. 7A, Jin discloses each of the pilot subcarrier channels is an unshared "parameter channel" used for identifying the corresponding user and the data is sent on the "shared communication channel":

FIG. 7A


Time
Frequency
Pattern 1
null
null
null
null
Time
Frequency
Pattern 2
null
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

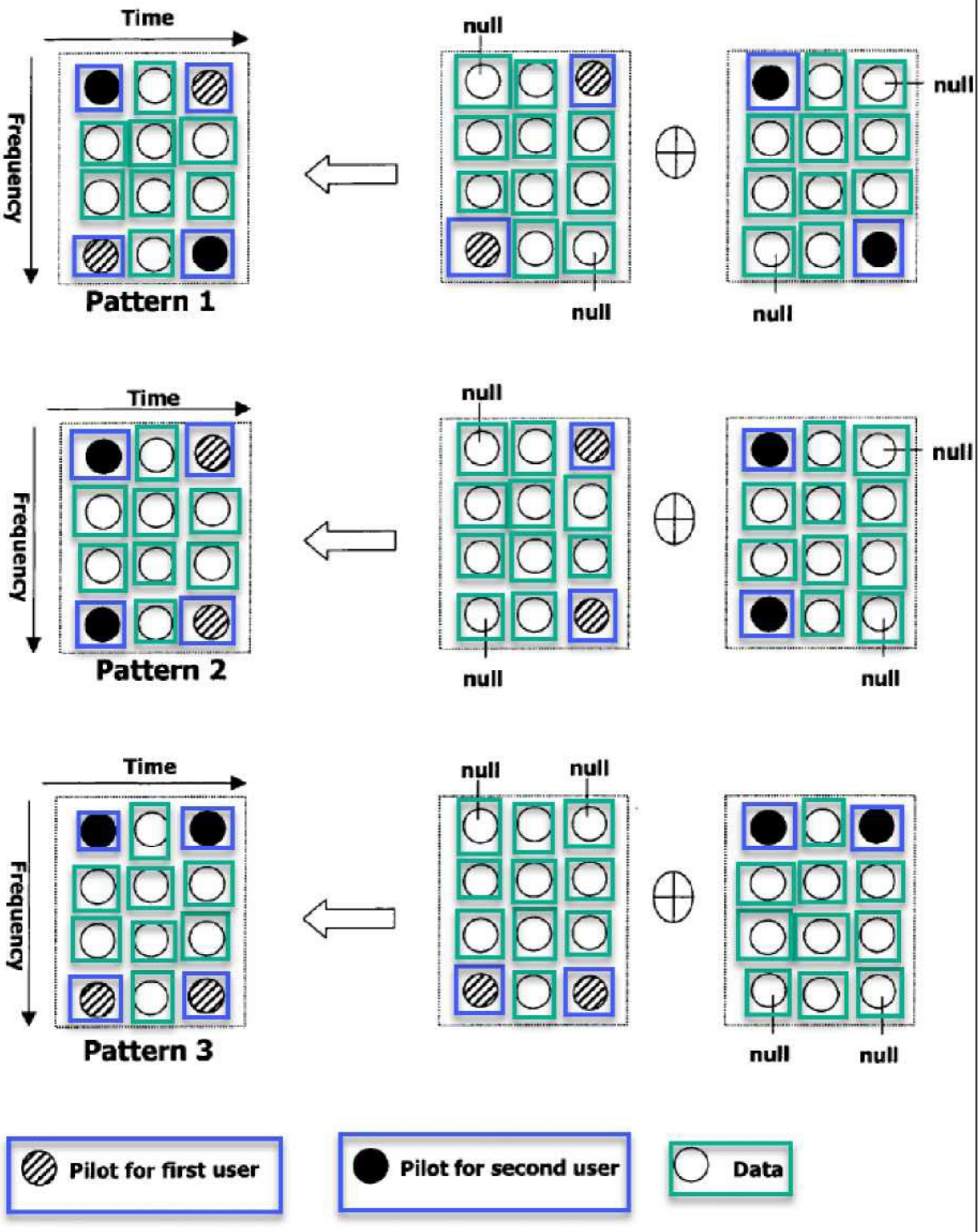
11. Claim 11

Jin discloses each user *(i.e.*, "**transmitting node**") transmits time and frequency division code type information (*i.e.*, "**spreading code type information**") on the pilot subcarrier subchannel (*i.e.*, "**unshared parameter channel**"). EX1003, ¶112. Jin discloses transmitting pilot patterns that indicate time and frequency division as it discloses "pattern 1 is pilots according to a time division and a frequency division, pattern 2 is pilots according to the frequency division, pattern 3 is pilots according to the time division, and pattern 4 is pilots according to a code division." EX1004, ¶75. Each of the pilot patterns are spreading code type information, as they are frequency and time division schemes. EX1003, ¶112. The '071 patent describes TDMA, FDMA, and CDMA as spreading technologies. *See*, *e.g.*, EX1001, 4:52-56. Thus, as Jin discloses the use of OFDMA and using different types of pilot patterns, each transmitting node must transmit spreading code type information on the unshared parameter channel. EX1004, ¶72; EX1003, ¶113.

12. Claim 16

Jin discloses more slots are allocated for the data subcarriers (*i.e.*, "**shared communication channel**") than the pilot subcarrier (*i.e.*, "**parameter channels**"), as shown in Fig. 7A. EX1003, ¶115.

FIG. 7A


Time
Frequency
Pattern 1
null
null
null
Time
Frequency
Pattern 2
null
null
null
Time
Frequency
Pattern 3
null
null
null
null
Pilot for first user
Pilot for second user
Data

A POSITA would have understood that the parameter channels are low in communication rate compared to the shared communication channel as fewer time slots means that it has a lower communication rate. EX1003, ¶116.

13. Claim 21

Claim 21 mirrors the above claims as set forth in the following chart, except that the steps recited in claim 21 are broader than those in claim 1, because they omit limitation 1a. Jin thus renders these claims obvious for the same reasons as above.

Claim Limitation	Corresponding Claim Limitation(s)
21 pre	1pre
21a	1b
21b	1c
21c	1d.

B. Ground 2: Claims 6-7 are obvious over Jin and Tsai

To the extent PO argues claims 6 and 7 are not obvious over Jin alone, these claims are nonetheless obvious over the combination of Jin and Tsai. Tsai is a Samsung patent application publication directed to wireless networks that promote simultaneous transmissions between multiple mobile stations. EX1006, Abstract, ¶8. Tsai contains several teachings that would have been obvious to incorporate into Jin: the use of signal amplitude and the use of signal phase as signal parameters. EX1003, ¶120.

Claims 6 and 7 recite that the unique signal parameter is a signal amplitude or phase. Using signal amplitudes and phases for identifying data was well known as these are parameters that differentiate signals. EX1003, ¶121. Tsai describes one such method for identifying data for a user by using signal amplitude or phase, and it would have been obvious to modify Jin to include Tsai's teachings.

1. Motivation to Combine

A POSITA would have been motivated to apply Tsai's teaching of a signal amplitude or phase for use as one of Jin's signal parameters. EX1003, ¶¶122-128. A POSITA would have known that in estimating the channel from the transmitter to the receiver, a known amplitude and phase timing of the transmitted signal, *e.g.*, pilot, are compared with the amplitude and phase of the actually received signal. EX1003, ¶122. The differences between the transmitted amplitude and phase timing and those of the received signal are used to estimate the channel. *Id.* The amplitude and phase information are parameters that are sent by the transmitters to the receiver to allow the receiver to differentiate the signals from each transmitter. *Id.* For example, an earlier patent assigned to Collision (U.S. Patent No. 6,947,505) discloses that a parameter estimator will estimate parameters including "the received power, phase of the oscillator, timing offset relative to the base station clock carrier frequency offset, and number of multipaths," and various other parameters.

EX1014, Abstract. A POSITA would have understood that a known amplitude and phase timing would be sent by the transmitters to the receiver to be used by the receiver to estimate signals as it was well known in the art that a parameter estimator in "any ... highly loaded or overloaded system[]" would use those parameters. *Id*, 1:25-32; EX1003, ¶122. Jin discloses the use of different signal parameters to identify the user for the data transmission, including amplitude and phase. EX1004, ¶77. Tsai provides the express teaching of the well-known technique of sending the amplitude and phase parameters to the receiver and the receiver using the amplitude and phase as the signal parameter to identify a user.

Tsai teaches "MIMO channel estimation consists of estimating the channel gain and phase information" to differentiate signals from different devices. EX1006, ¶52. Tsai also teaches the well-known technique of using successive interference cancellation to recover the transmitted data stream where the highest amplitude signal is subtracted successively. EX1006, ¶51; EX1003, ¶123. In performing this process, the signal amplitude and phase must be known or determined and used to perform the signal identification. *Id.* A POSITA would have understood that, in order to estimate the channel gain and phase information, the receiver must know or estimate the amplitude and phase timing of the transmitted signal and the transmitter must send amplitude and phase information over the parameter channel for the

receiver to use in estimating the signals. EX1003, ¶123. Tsai discloses estimating the channel gain and phase information, and a POSITA would have thus understood that Tsai so discloses the "unique signal parameter comprises signal amplitude" (claim 6) and the "unique signal parameter comprises a signal phase" (claim 7). *Id.*

Jin teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a MIMO system. EX1004, ¶¶73-76, ¶89; EX1003, ¶124. Like Jin, Tsai discloses a MIMO system where multiple signals are simultaneously transmitted and the amplitude and phase are used to differentiate the signals. EX1006, ¶52 ("MIMO channel estimation consists of estimating the channel gain and phase information for links").

A POSITA would have been motivated to use signal amplitudes and phases for signal identification in Jin, as taught by Tsai. EX1003, ¶125. As noted above, and as confirmed in other Collision patents, a POSITA would have known that in estimating the channel from the transmitter to the receiver, a known amplitude and phase timing of the transmitted signal, *e.g.*, pilot, are transmitted to the receiver over a parameter channel and are then compared with the amplitude and phase of the actually received signal, and that the differences are conventionally used to estimate the channel. *Id.* A POSITA would have been motivated to use amplitude and phase timing as parameters because they are inherently part of the transmitted signals, and

are thus simple and effective parameters that may be used to distinguish different transmitted signals. *Id.*

Given the numerous well-known benefits from using different phase and amplitudes for signals with MIMO and OFDM transmissions, a POSITA would have been motivated to include signal amplitude or phase as taught by Tsai as part of Jin's signal parameter to differentiate between different user signals. *Id*., ¶126. For example, the use of signal phase and amplitude to differentiate signals would have been readily apparent to a POSITA, as it provides the benefit of distinguishing signals without requiring further processing of the signals. *Id.* Additionally, as Jin already discloses a base station that can estimate amplitude and phases in the received signals, using the channel gain and phase to determine amplitude and phase as disclosed by Tsai would have been a known substitute. Moreover, the sending of the amplitude and phase parameters over the parameter channel, instead of the data channel, would have been known to a POSITA as parameter channel was known to have information unique to a particular transmitting device and sending this information over a shared data channel would cause issues with disaggregating the signals. *Id*.

A POSITA would have reasonably expected this combination to succeed. *Id*, ¶127. Estimating the channel from the received phase and amplitude with the known

phase and amplitude of the transmitted signal for signals with MIMO and OFDM transmissions had long been known in the field and a POSITA would have been familiar with its implementation, including as described by Tsai, estimating the channel gain and phase information. *Id.*, ¶127. Estimating the channel conditions from the received phase and amplitude parameter over a parameter channel in Jin would have been well within the capabilities of a POSITA. *Id.*, ¶127. Jin already discloses that the signals have known amplitude and phase parameters (EX1004, ¶77) and the use of these known parameters to identify the user was well known in the art. EX1003, ¶127.

Finally, Jin, Tsai, and the '071 patent are analogous art because all three are directed to the same field of multi-user detectors, that is, simultaneously transmitting multiple types of information over a network. EX1001, Abstract; EX1004, Abstract; EX1006, Abstract; EX1003, ¶128.

2. Claim 6

Jin in view of Tsai renders obvious claim 6. EX1003, ¶129. Tsai discloses that "MIMO channel estimation consists of ***estimating the channel gain*** and phase information for links." EX1006, ¶52. The channel gain in Tsai corresponds to the **signal amplitude** of the received signal. *Id.* As discussed above, it would have been obvious to a POSITA to use a signal amplitude parameter, as disclosed by Tsai,

transmitted over Jin's unshared parameter channel, to differentiate different user signals. EX1003, ¶129.

3. Claim 7

Jin in view of Tsai renders obvious claim 7. EX1003, ¶130. Tsai discloses "MIMO channel estimation consists of ***estimating the channel*** gain and ***phase information for links.***" EX1006, ¶52. The phase information in Tsai is used to determine the **signal phase** of the received signal. *Id.* As discussed above, it would have been obvious to a POSITA to use a signal phase parameter, as disclosed by Tsai, transmitted over Jin's unshared parameter channel, to differentiate different user signals. EX1003, ¶129.

C. Ground 3: Claims 8-9 are obvious over Jin and Vrzic

Vrzic is an Apple patent application publication directed to wireless networks that promote simultaneous transmissions between multiple mobile stations. EX1007, Abstract. Vrzic contains several teachings that would have been obvious to incorporate into Jin: using a signal's carrier frequency offset and time delay to differentiate the signals in a wireless network. EX1003, ¶¶131-132.

Using a signal's carrier frequency offset and time delay to differentiate the signals in a wireless network was well known, as these signal parameters inherently identify different signals in a shared communication channel. EX1003, ¶133. Vrzic

describes using frequency offset and clock estimation logic to identify different signals and provide estimates for the signals based on the identified offsets and delays, and it would have been obvious to modify Jin to include Vrzic's teachings. EX1003, ¶¶132-133.

1. Motivation to Combine

A POSITA would have been motivated to apply Vrzic's teaching of a signal carrier frequency offset and signal relative time delay for use as one of Jin's signal parameters. EX1003, ¶¶134-143. Indeed, Jin discloses the use of different signal parameters to identify the user for the data transmission, including frequency and time but does not expressly describe using carrier frequency ***offset*** or time ***delay*** as signal parameters. EX1004, ¶77. Vrzic provides these teachings. EX1003, ¶134.

(a) Frequency Offset

Using signal carrier frequency offset is a well-known technique for signal differentiation. EX1003, ¶135. Signal carrier frequency offset refers to subcarrier frequencies differing from their intended values. Such differences can happen due to, for example, oscillator error or temperature drift. *Id.* Vrzic teaches using "synchronization logic 94 include[ing] frequency offset and clock estimation logic 106, which is based on the headers to help estimate such effects on the transmitted signal and provide those estimations to the correction logic 104 to properly process

OFDM symbols" to differentiate signals from different devices. EX1007, ¶41. A POSITA would have known that the technique for estimating the signal carrier frequency offset taught by Vrzic can be incorporated into Jin to aid the process of separating multiple signals, because different transmitting devices will have different carrier frequency offsets. EX1003, ¶135.

Jin teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a MIMO system. EX1004, ¶¶73-76; EX1003, ¶136. A POSITA would have been motivated to incorporate Vrzic's signal carrier frequency offset with Jin because of the well-known benefits of using such an offset for signal differentiation. EX1003, ¶136. For example, using offsets in carrier frequency is a simple and effective way to differentiate multiple signals in a shared communication channel. *Id.* Additionally, as Vrzic explains, using carrier frequency offsets allows for "properly processing] OFDM symbols" like those taught in Jin. EX1007, ¶¶41, 44.

Given the numerous well-known benefits from using different signal carrier frequency offset for signals with MIMO and OFDM transmissions, a POSITA would have been motivated to incorporate Vrzic's signal carrier frequency offset into Jin's signal parameter. EX1003, ¶137.

A POSITA would have reasonably expected this combination to succeed. EX1003, ¶138. Using different signal carrier frequency offset for signals with MIMO and OFDM transmissions had long been known in the field and a POSITA would have been familiar with its implementation, including as described by Vrzic. *Id.* Implementing different signal carrier frequency offset and signal relative time delay for signals in Jin would have been well within the capabilities of a POSITA, especially because Jin already discloses the use of MIMO and OFDM, which was known to already support different signal carrier frequencies. *Id.* A POSITA would therefore understand Jin was compatible and readily applicable for using different signal carrier frequency offset for signals. *Id.*

(b) Time Delay

Using signal time delays is a well-known technique for signal differentiation. EX1003, ¶139. In a system with multiple signals, a system can use the time delay in the signals to identify the node that sent it. EX1003, ¶139. Time delays are efficient because they take the known time parameter and can compare the time values to determine delays. *Id.* An earlier patent assigned to Patent Owner (U.S. Patent No. 6,947,505) discloses that a parameter estimator will estimate parameters including "the timing offset relative to the base station clock, any frequency offset of the carrier," and various other parameters. EX1014, Abstract. A POSITA would

understand that a clock estimation unit is used to derive the timing delay as it was well known in the art that a parameter estimator in "any ... highly loaded or overloaded system[]" would determine timing delay "relative to the base station clock." *Id*., 1:25-32. Using a time delay was known as a simple and effective way to differentiate signals in a network, and Vrzic teaches "the synchronization logic 94 includes frequency offset and clock estimation logic 106, which is based on the headers to help estimate such effects on the transmitted signal and provide those estimations to the correction logic 104 to properly process OFDM symbols" to differentiate signals from different devices. EX1003, ¶41; EX1003, ¶139.

Jin teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a MIMO system. EX1004, ¶¶73-76; EX1003, ¶140. A POSITA would have been motivated to incorporate Vrzic's signal relative time delay with a MIMO system like Jin because of the well-known benefits of using a time delay for signal differentiation. EX1003, ¶140. Time delays are a known parameter that already existed in networks and, as Vrzic explains, "pilot symbol pattern and density value may be chosen based on the size of the contiguous resource and a multi-antenna transmission and reception (MIMO) mode" and "properly process OFDM symbols" such as taught in Jin. EX1007, ¶41, 44; EX1003, ¶140. Moreover, a POSITA would have known that the OFDM frames are identified in

their timing using such a parameter as the system frame number, from which the difference between the transmitted time and the time of reception can be determined. EX1003, ¶140. Additionally, a POSITA would understand that a clock estimation unit is used to derive the timing delay as it was well known in the art that a parameter estimator in "any ... highly loaded or overloaded system[]" would determine timing delay "relative to the base station clock." EX1014, 1:25-32; EX1003, ¶140. This description of an OFDM signal with signal carrier frequency offset and signal relative time delay differentiations is consistent with the signals used by Jin. EX1003, ¶140.

Given the numerous well-known benefits from using different signal relative time delay for signals with MIMO and OFDM transmissions, a POSITA would have been motivated to incorporate Vrzic's signal relative time delay differentiations into Jin's signal parameter. EX1003, ¶141. Indeed, Jin states its system is applicable to MIMO and OFDM, and it was known that MIMO and OFDM were already capable of differentiating signal relative time delay for signals. EX1004, ¶89 (identifying MIMO); EX1007, ¶41 ("pilot symbol pattern and density value may be chosen based on the size of the contiguous resource and a multi-antenna transmission and reception (MIMO) mode"). This provides further motivation for a POSITA to look to Vrzic. EX1003, ¶141.

A POSITA would have reasonably expected this combination to succeed. EX1003, ¶142. Using different signal relative time delay for signals with MIMO and OFDM transmissions had long been known in the field and a POSITA would have been familiar with its implementation, including as described by Vrzic. Implementing different signal relative time delay for signals in Jin would have been well within the capabilities of a POSITA, especially because Jin already discloses the use of MIMO and OFDM, which was known to be capable of implementing different signal relative time delay. *Id.* A POSITA would therefore understand Jin was compatible and readily applicable for using different signal relative time delay for signals. *Id.*

(c) Analogous Art

Finally, Jin, Vrzic, and the ’071 patent are analogous art because all three are directed to the same field of multi-user detectors, that is, simultaneously transmitting multiple types of information over a network. EX1001, Abstract; EX1004, Abstract; EX1007, Abstract; EX1003, ¶143.

2. Claim 8

Jin in view of Vrzic render obvious claim 8. EX1003, ¶144. Vrzic states with MIMO and OFDM, “the ***synchronization logic*** 94 ***includes frequency offset*** and clock estimation logic 106, which is based on the headers to help ***estimate such***

effects on the transmitted signal and provide those estimations to the correction logic 104 to properly process OFDM symbols." EX1007, ¶41. It would have been obvious to a POSITA to use Vrzic's frequency offset logic, which determines a signal carrier frequency offset, to differentiate signals for the reasons provided above. EX1003, ¶144. Vrzic also discloses that it uses this parameter to "properly process OFDM signals." EX1007, ¶41. In the Jin-Vrzic combination, Jin would transmit information relating to signal carrier frequency offset on the unshared parameter channel, to differentiate different user signals. EX1003, ¶144.

3. Claim 9

Jin in view of Vrzic render obvious claim 9. EX1003, ¶145. Vrzic states with MIMO and OFDM, "the ***synchronization logic*** 94 ***includes*** frequency offset and ***clock estimation logic*** 106, which is based on the headers to help ***estimate such effects on the transmitted signal*** and provide those estimations to the correction logic 104 to properly process OFDM symbols." EX1007, ¶41. Vrzic's clock estimation logic uses time delay offset to differentiate signals, as Vrzic discloses that it uses this parameter to provide estimates and "properly process OFDM signals." *Id.* This disclosure in Vzric is consistent with a POSITA's understanding in the art, as it was well known in the art that a parameter estimator in "any ... highly loaded or overloaded system[]" would determine timing delay "relative to the base station

clock." EX1014, 1:25-32; EX1003, ¶145. In the Jin-Vrzic combination, Jin would transmit information relating to timing delay on the unshared parameter channel, to differentiate different user signals. EX1003, ¶145.

D. Ground 4: Claims 1-11, 16, 21 Are Rendered Obvious by Baum

Baum renders obvious claims 1-11, 16, and 21. EX1003, ¶¶146-178.

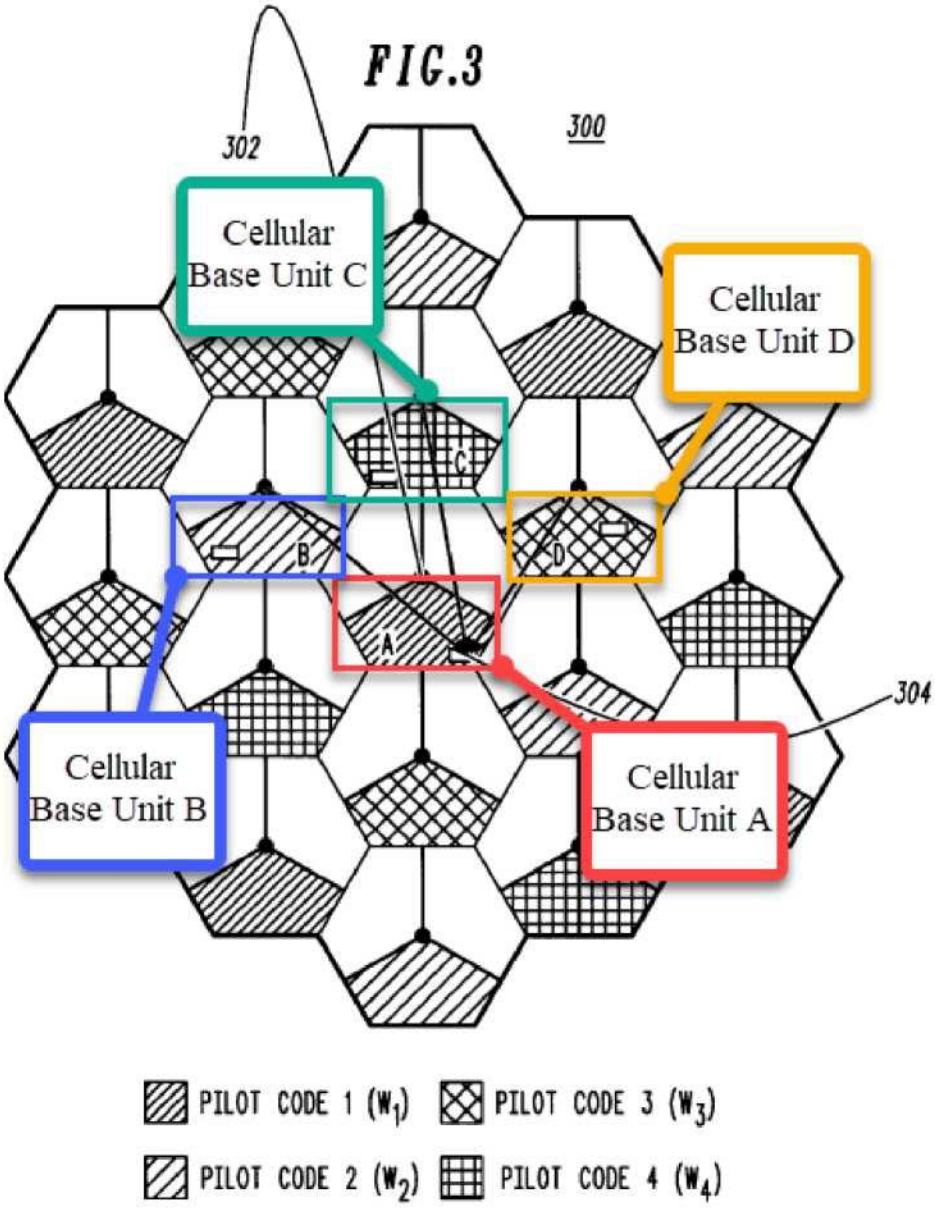
1. 1pre

Baum discloses this claim limitation to the extent the preamble is limiting. EX1003, ¶¶148-152.

A Method for Enabling a Receiving Node to Distinguish Information Simultaneously Received: The **receiving node** in Baum is a subscriber unit (subscriber 304 in sector A), which receives "simultaneously" from the four base units. EX1005, 6:7-32. The signal from base unit A is the "desired" signal and the signals from other base units B, C, D are "interfering signal[s]." *Id*, 6:9-21. Baum also discloses using "joint detection," where co-channel interfering signals are also joint desired signals in the detection process. *Id.*, 18:1-15. The multiple signals that are received simultaneously (*e.g.*, the "joint desired signal," or the sum of the desired and the interfering signal components) are thus **distinguished** in the detection process. EX1003, ¶149. Baum discloses using joint detection with the detection scheme in all of the embodiments, as it states that "diversity reception [like that

disclosed in Fig. 3] is still beneficial even when joint detection is employed." EX1005, 18:6-8; EX1003, ¶149. Additionally, Baum discloses that "joint detection" is "referred to as multi-user detection" and all of the embodiments in Baum use multi-user detection as they are transmitting interfering signals for multiple base stations over the same shared channels. EX1005, 5:17-47, 18:1-8.

From A Plurality of Transmitting Nodes: Baum discloses a cellular network with four base units in sectors A, B, C, D, one for each user, respectively, which are transmitting ("**a plurality of transmitting nodes**"). EX1003, ¶150.



Transmitting ... on a Shared Communication Channel: The four base units are transmitting on the same channel ("**shared communication channel**") as they generate one desired signal for a given mobile terminal and three co-channel interfering signals. EX1005, 6:21-23; EX1003, ¶151. Baum's interfering signal

disclosure is the same as Patent Owner's mapping in its infringement contentions in the district court litigation, as Patent Owner has mapped the shared communication channel to the data portion of a frame. EX1013, 25; EX1003, ¶151.

Of a Wireless Digital Network: Baum's cellular network uses digital modulation ("**wireless digital network**"), such as a QAM or QPSK. EX1005, 4:16-27, 13:49-54; EX1003, ¶152.

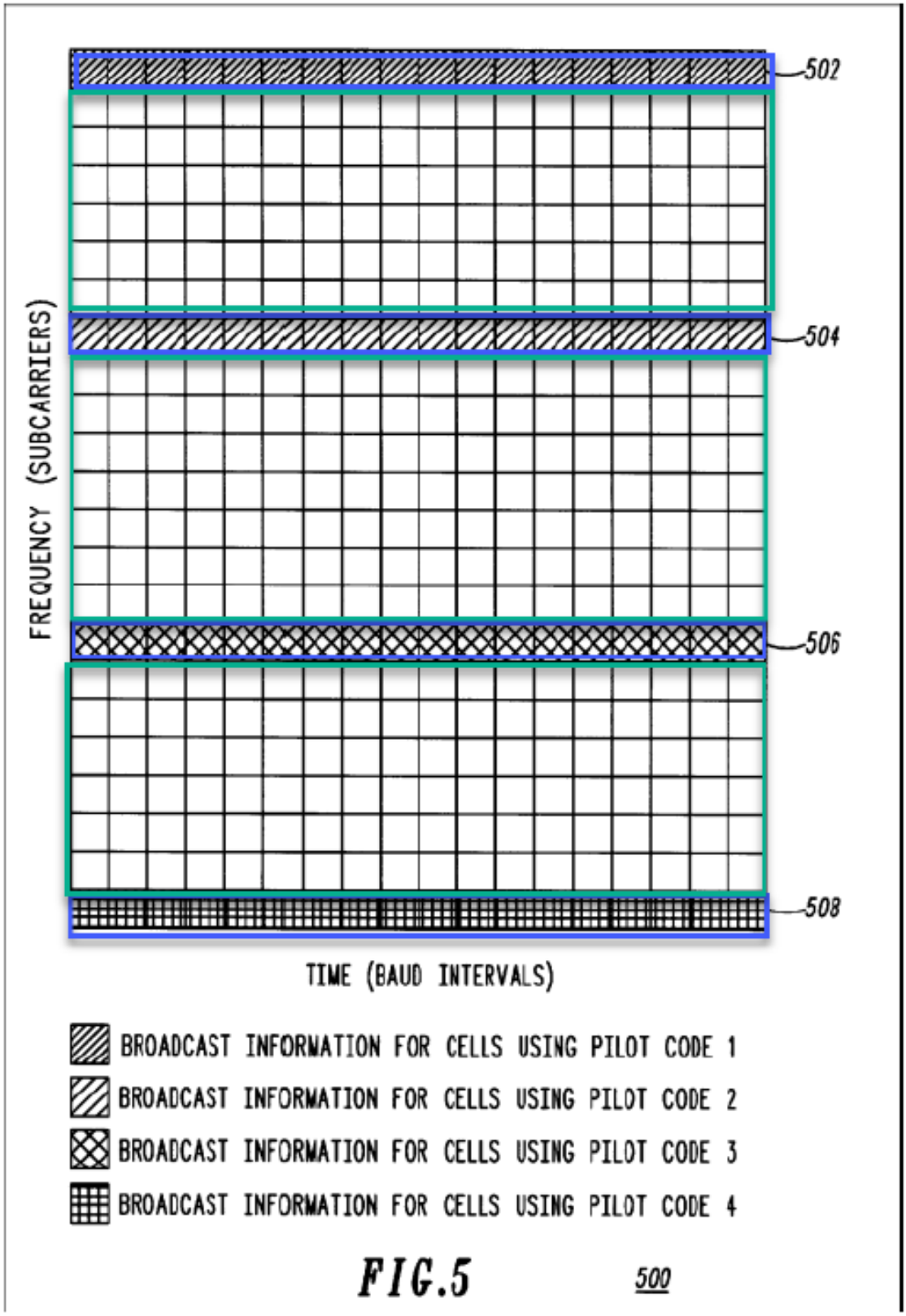
(a) 1a

Baum discloses a plurality of parameter channels on the network as it uses synchronization signals from different base stations that occupy different regions of time and/or frequency in a frame, which allow a subscriber unit to measure or monitor each synchronization signal without co-channel interference. EX1005, 9:14-33, 19:3-29; EX1003, ¶154. Each different region of time and/or frequency in a frame dedicated to a synchronization signal is a "parameter channel" *(i.e.*, "**plurality of parameter channels**"). *Id.* The parameter channel in Baum is not shared, as Baum discloses a synchronization signal from one transmitter being transmitted "***at a different time/frequency***" than the synchronization signal transmitted by the other transmitter. EX1005, 8:53-57, 24:19-50; EX1003, ¶154. Baum's disclosure of the plurality of parameter channels is further supported by Patent Owner's infringement contentions in the district court litigation, as Patent

Owner has mapped the plurality of parameter channels to a different frequency or time for transmitting the parameter. EX1013, 25; EX1003, ¶154.

The synchronization signals in Baum are used to estimate parameters as they estimate phase differences across subcarriers in each signal demodulated in joint detection so the receiver can compensate for these phase differences. EX1003, ¶155. Baum discloses the estimate of "adjacent-subcarriers phase difference" is "based on a received signal containing known data such as the broadcast synchronization signal" where, as part of the demodulation of a received OFDM signal, a subcarrier phase difference is estimated based on a synchronization signal for both the desired signal and the interfering signals. EX1005, 19:3-59; EX1003, ¶155.

In Fig. 5, Baum discloses each of the subcarriers that carries a synchronization signal as the "parameter channel" and the other subcarriers represent at least one "shared communication channel". EX1003, ¶156.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TIME (BAUD INTERVALS)
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BROADCAST INFORMATION FOR CELLS USING PILOT CODE 2
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 3
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 4

FIG.5 500

(b) 1b

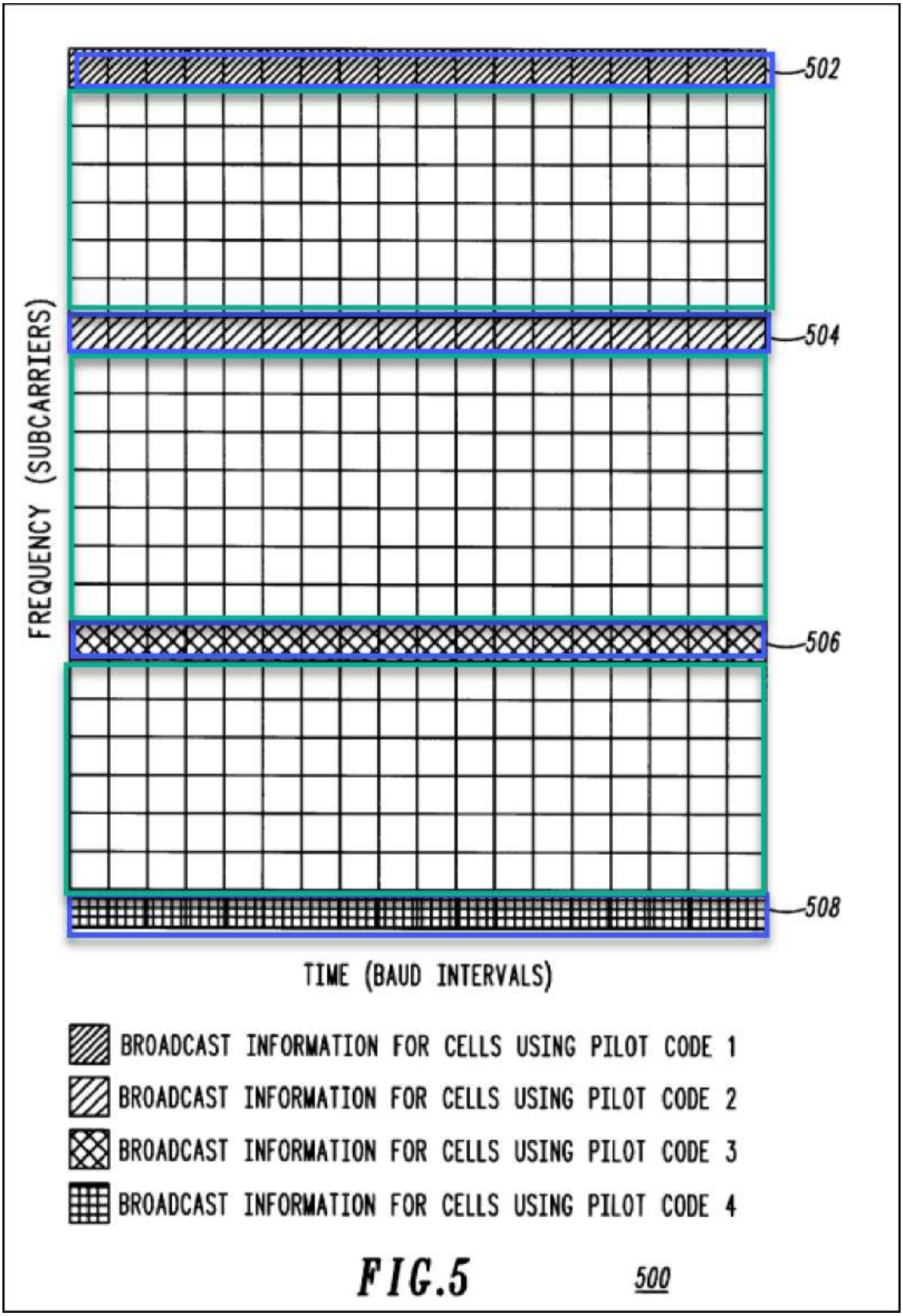
Parameter Estimating Signal: Baum discloses a synchronization signal as the claimed parameter-estimating signal. EX1003, ¶158. Baum discloses monitoring synchronization signals to measure parameters, as "the subscriber unit is able to measure/monitor the synchronization signal from the dominant co-channel interfering sectors of the surrounding cells .... [T]he subscriber unit .. measure[s] the relative propagation delay of the interfering signals, which directly affects the amount of phase change per subcarrier on the interfering signals after demodulation." EX1005, 9:27-33. The synchronization signals in Baum are the "parameter-estimating signal" as they are used to estimate relative propagation delays and adjacent-subcarriers phase differences. EX1005, 9:27-36; EX1003, 1158.

Each transmitting node transmits a parameter-estimating signal on an unshared said parameter channel: Baum discloses that synchronization signals from two different base stations are "non-interfering," as they are transmitted using different "time/frequency" resources. EX1005, 10:5-11, 24:39-50; EX1003, ¶159. Baum discloses "synchronization signals may typically be one of: A) non-interfering with a synchronization/identification signal from another SC-OFDM transmitter... the SC-OFDM transmitter may transmit at least one of the synchronization signal

and the identification signal at a different time/frequency/[] than the synchronization/identification signal transmitted by the other SC-OFDM transmitter." EX1005, 24:39-50. Baum's different, non-interfering, time and/or frequency regions for transmitting synchronization signals ("parameter-estimating signal") are the claimed "unshared said parameter channel." EX1003, ¶159.

(c) 1c

Detecting the Parameter-Estimating Signals on the Unshared Parameter Channels: Baum discloses the synchronization signals *(i.e.*, "**parameter-estimating signals**") are detected on different, non-interfering, time and/or frequency regions (*i.e.*, "**the unshared parameter channels**"). EX1005, 9:24-36; EX1003, ¶161. This is shown in Fig. 5 below, where the unshared parameter channels have different time and frequency regions. EX1003, ¶161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BROADCAST INFORMATION FOR CELLS USING PILOT CODE 1
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 2
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 3
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 4

FIG.5 500

Estimating ... at Least One Unique Signal Parameter for Each of the Transmitting Nodes: Baum discloses estimating the relative propagation delay and subcarrier phase difference information *(i.e.*, "**at least one unique signal parameter**") for each of the base stations (*i.e.*, "**each of the transmitting nodes**"). EX1005, 9:24-36, 19:3-20:56; EX1003, ¶162. Baum discloses deriving the subcarrier phase difference for different signals from the relative propagation delay of the signals, as measured from synchronization signals ("parameter-estimating signals") transmitted from different base stations. *Id.* The subcarrier phase difference is related to the "relative propagation delay" of different interfering signals and, thus, the phase differences for each of the base stations are "unique." *Id*.; EX1003, ¶162.

(d) 1d

Baum discloses detecting and distinguishing the information simultaneously received from each of the base stations (*i.e.*, "**transmitting nodes**") according to their respective relative propagation delay and subcarrier phase difference information (*i.e.*, "**unique estimated signal parameters**"). EX1005, 9:11-36, 18:1-15, 19:50-62. Baum discloses using a joint detection reception scheme that distinguishes information simultaneously received from multiple transmitters as "co-channel interfering signal components can be treated as joint desired signals in

the detection process" (*i.e.*, "**information simultaneously received**"). *Id*., 18:1-15; EX1003, ¶163. Baum discloses the subcarrier phase difference is "accounted for in the detection algorithms in the receiver." *Id*., 9:11-36. Joint detection is implemented with the subcarrier phase difference estimated from a synchronization signal, as "an OFDM receiver estimates the adjacent-subcarriers phase difference and compensates for the estimated adjacent-subcarriers phase difference in the detection process ... [and t]he estimate ... can be obtained ... based on ... the broadcast synchronization signal." *Id.*, 19:50-62; EX1003, ¶163. Baum discloses estimating the "adjacent-subcarriers phase difference" for each "component"/signal in a "composite" received signal and using these phase differences in the "detection process," including "interpolation filtering." EX1005, 21:3-21. Thus, Baum discloses "**detecting and distinguishing**" the received information. EX1003, ¶163.

Baum discloses using joint detection with the detection scheme in all of the embodiments, as it states that "diversity reception [like that disclosed in all embodiments] is still beneficial even when joint detection is employed." EX1005, 18:6-8. A POSITA would have known that the diversity reception refers to receiving multiple copies of signals, traversed over different physical paths at one or more receiving antennae. EX1003, ¶164. Baum discloses using joint detection in every embodiment as Baum discloses that "joint detection" is "referred to as multi-user

detection" and all of the embodiments in Baum use multi-user detection as they are transmitting interfering signals for multiple base stations over the same shared channels. EX1005, 5:17-47, 18:1-8; EX1003, ¶164.

2. Claim 2

Baum discloses using channel-spreading technology, like time division and frequency division *(i.e.*, "**channel-spreading technology**"), to provide a plurality of parameter channels. EX1005, 8:53-57, 9:2-13, 19:50-62; EX1003, ¶165. Baum's disclosure of time division and frequency division is consistent with the '071 patent's characterization of "time division" and "frequency division" as channel-spreading technology. EX1001, 2:42-60; EX1003, ¶165.

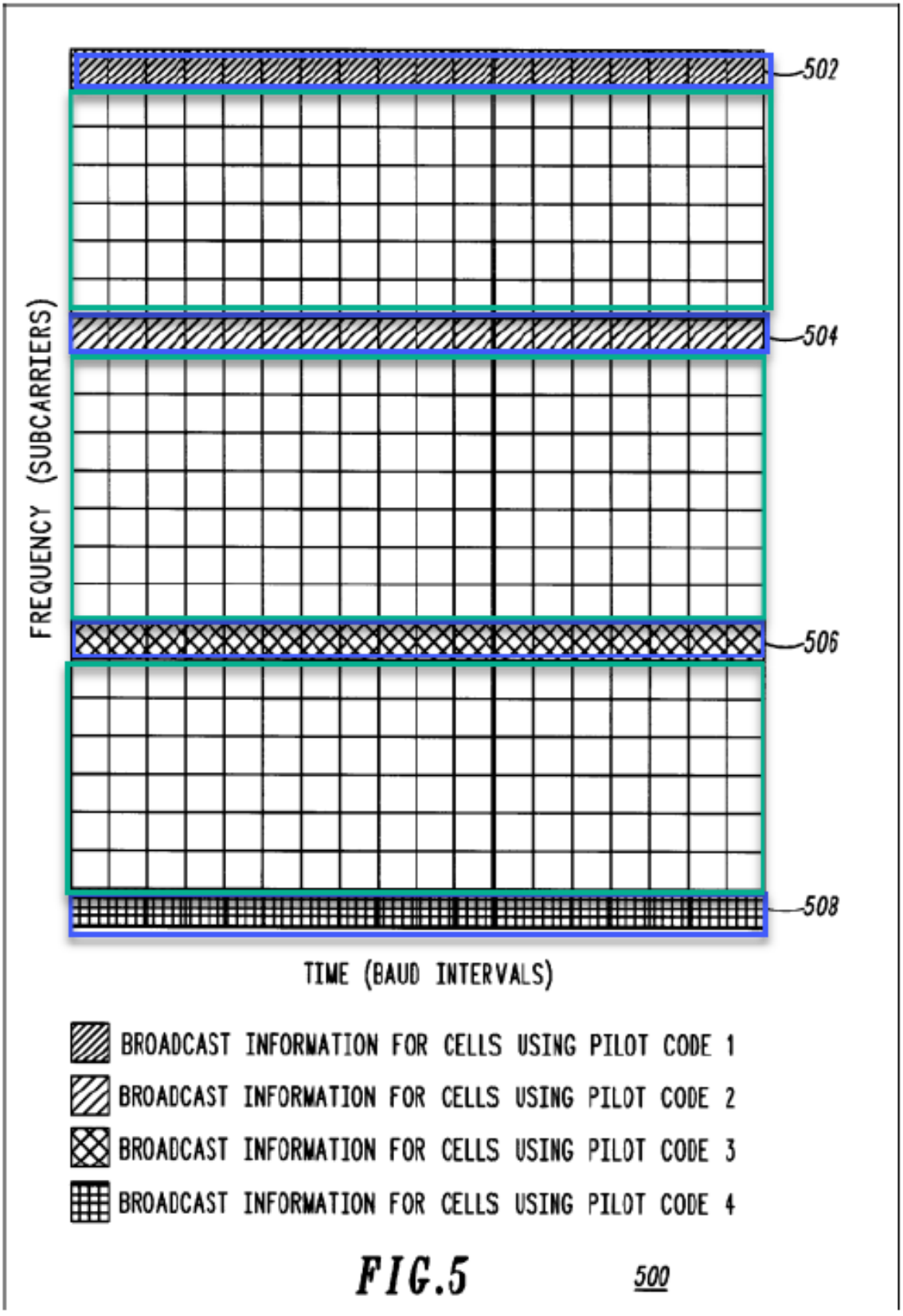
3. Claim 3

Baum discloses using time division ("**TDMA**") and frequency division ("**FDMA**") to provide a plurality of parameter channels. EX1005, 8:53-57, 19:50-62; EX1003, ¶166.

4. Claim 4

Baum discloses each base station (*i.e.*, "**transmitting node**") transmits the synchronization signals (*i.e.*, "**parameter-estimating signal**") while simultaneously "data or other information" (*i.e.*, "**information**") on the data subcarrier (*i.e.*, "**shared communication channel**"). EX1005, 3:32-34, 7:48-58, 14:54-61. This is shown in Fig. 5, where synchronization signals are transmitted in a frame using subcarriers

identified as 502, 504, 506, 508 and the remaining subcarriers are used to transmit data and other information. EX1003, ¶167.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FREQUENCY (SUBCARRIERS)
TIME (BAUD INTERVALS)
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 1
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 2
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 3
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 4

FIG.5 500

Fig. 5 of Baum discloses "parameter channels" that use certain frequencies/subcarriers within a time interval, with the remainder of the frequencies/subcarriers available for data transmission from the base units in the same time interval. EX1003, ¶168. In order to use the frequencies available for data transmission *(i.e.*, "**shared communication channel[s]**"), a base unit transmits data at the same time (*i.e.*, "**simultaneously**") as a synchronization signal (*i.e.*, "**parameter-estimating signal**"). EX1005, 3:32-34, 7:48-58, 14:54-61; EX1003, ¶168.

5. Claim 5

Baum discloses the synchronization signals (*i.e.*, "**parameter-estimating signal**") are a symbol pattern as it is "a type of broadcast signal, and is preferably used to provide a known signal which the subscriber units 15 can monitor to acquire and/or maintain timing and/or frequency synchronization" (*i.e.*, "**parameter estimating symbol pattern**" '). EX1005, 9:14-17; EX1003, ¶169. Baum discloses that each time and frequency position in a frame defines the symbol and the symbol pattern is a pattern of signals encoded in one or more symbols. EX1005, 8:53-57, 19:50-62; EX1003, ¶169. Thus, a POSITA would understand that the synchronization signals in Baum are a symbol pattern. EX1003, ¶169.

6. Claim 6

Baum discloses the use of different signal parameters to identify the base station for the data transmission, including amplitude. EX1005, 4:65-5:10, 20:60-63; EX1003, ¶170. Baum discloses that the base station uses channel gain value, which corresponds to the signal amplitude (*i.e.*, "**signal amplitude**") as a unique parameter (*i.e.*, "**unique signal parameter**"). *Id.*

7. Claim 7

Baum discloses the use of different signal parameters to identify the base station for the data transmission, including phase (*i.e.*, "**signal phase**"). EX1005, 20:24-41, 20:64-21:2; EX1003, ¶171. Baum discloses that the base station uses the phase difference between signals as a unique signal parameter (*i.e.*, "**unique signal parameter**"). *Id*.

8. Claim 8

Baum discloses that synchronization signals are used to "acquire.. .frequency synchronization," and frequency synchronization "can be accomplished using one of the OFDM synchronization algorithms known in the art" (*i.e.*, "**unique signal parameters**"). EX1005, 9:11-17, 14:46-50; EX1003, ¶172. "Frequency synchronization" in OFDM includes frequency offset estimation (*i.e.*, "**signal carrier frequency offset**"). EX1003, ¶172. An earlier patent assigned to Patent Owner (U.S. Patent No. 6,947,505) discloses that a parameter estimator will estimate

parameters including "any frequency offset of the carrier," and various other parameters. EX1014, Abstract. A POSITA would understand that frequency synchronization involves determining the frequency offset as it was well known in the art that a parameter estimator in "any ... highly loaded or overloaded system[]" would determine frequency offset. *Id.*, 1:25-32; EX1003, ¶172. It would have been obvious to a POSITA to use the carrier frequency offset to also distinguish between different transmitted signals, as a POSITA would understand that each transmitting device would have a different carrier frequency offset that may be used as a unique signal parameter to identify different transmitted signals. EX1003, ¶172.

9. Claim 9

Baum discloses the "subscriber unit is able to measure the synchronization signal from the base unit in its own cell without the detrimental effects of strong cochannel interference ... [and] measure/monitor the synchronization signal from the dominant co-channel interfering sectors of the surrounding cells ... to ***measure the relative propagation delay of the interfering signals***." EX1005, 9:24-36. Relative propagation delays are "relative time delays" as "propagation delay" refers to the ***time*** it takes the signal to travel from the transmitter to the receiver *(i.e.*, the delay between when the signal is transmitted and when it is received), which will be different for each transmitter (*i.e.*, "**signal relative time delay**"). EX1003, ¶173. An

earlier patent assigned to Collision (U.S. Patent No. 6,947,505) discloses that a parameter estimator will estimate parameters including "the timing offset relative to the base station clock, any frequency offset of the carrier," and various other parameters. EX1014, Abstract. A POSITA would understand that a clock estimation unit is used to derive the timing delay as it was well known in the art that parameter estimator in "any ... highly loaded or overloaded system[]" would determine timing delay "relative to the base station clock." *Id.*, 1:25-32; EX1003, ¶173.

10. Claim 10

Baum discloses requiring each base station (*i.e.*, "**transmitting node**") to transmit identification signals *(i.e.*, "**node identifying information**") on the different, non-interfering, time and/or frequency regions (*i.e.*, "**the unshared parameter channels**"). *Id.* Baum discloses the scheme of transmitting synchronization signals is used to transmit ***"identification" signals***. EX1005, 14:24-33, 24:39-50. Baum discloses *"**transmitting]*** at least one of: synchronization signals and ***identification signals*** ... [and] ***transmitting]*** at least one of the synchronization signal and the ***identification signal at a different time/frequency/[]*** than the synchronization/identification signal transmitted by the other SC-OFDM transmitter." EX1005, 24:39-50. Additionally, Baum discloses that synchronization

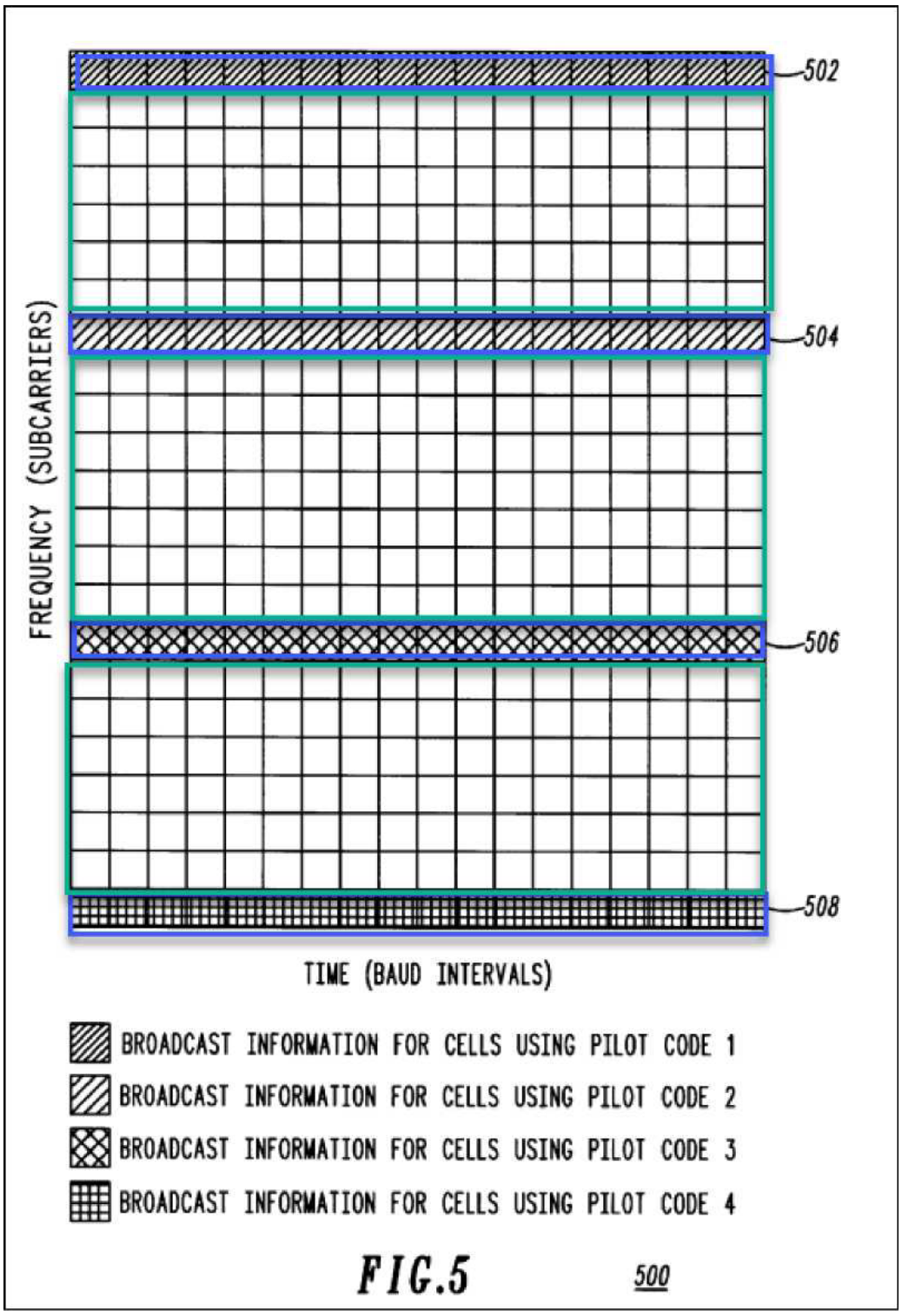
signals from different base units are monitored to determine which provides the "best signal quality" to identify a serving base unit. EX1005, 14:24-33. The different synchronization signals are unique to their associated base units, which means the synchronization signals identify different base units. EX1003, ¶174.

11. Claim 11

Baum discloses requiring each base station *(i.e.*, "**transmitting node**") to transmit time and frequency division code type information (*i.e.*, "**spreading code type information**") on the unshared synchronization subcarriers (*i.e.*, "**unshared parameter channel**"). Baum discloses using spreading code type information on the unshared parameter channel, like time division and frequency division. EX1005, 9:11-17, 14:46-50; EX1003, ¶175. Each of the synchronization code patterns are spreading code type information, as they are frequency and time division schemes. EX1003, ¶175. The '071 patent describes TDMA and FDMA, as well as the CDMA, as the spreading technology. *See*, *e.g.*, EX1001, 4:52-56. Thus, as Baum discloses the use of OFDMA and using different types of synchronization code patterns, it discloses each transmitting node transmits spreading code type information on the unshared parameter channel. EX1005, 8:53-57, 19:50-62; EX1003, ¶175.

12. Claim 16

Baum discloses the parameter channels are low in communication rate compared to the shared communication channel, as it discloses "different data rates are supported by assigning different numbers of slots" and the higher data rate is achieved by assigning more slots. EX1005, 13:38-48. As shown in Fig. 5, Baum discloses the "parameter channel" has fewer slots than the "shared communication channel". EX1003, ¶176.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FREQUENCY (SUBCARRIERS)
TIME (BAUD INTERVALS)
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 1
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 2
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 3
BROADCAST INFORMATION FOR CELLS USING PILOT CODE 4

FIG.5 500

A POSITA would have understood that the parameter channels are low in communication rate compared to the shared communication channel as fewer time slots means that it has a lower communication rate. EX1003, ¶177.

13. Claim 21

Claim 21 mirrors the above claims as set forth in the following chart, except that the steps recited in claim 21 are broader than those in claim 1, because they omit limitation 1a. Baum thus renders these claims obvious for the same reasons as above.

Claim Limitation	Corresponding Claim Limitation(s)
21 pre	1pre
21a	1b
21b	1c
21c	1d

E. Ground 5: Claims 6-7 are obvious over Baum and Tsai

To the extent Patent Owner argues claims 6 and 7 are not obvious over Baum alone, these claims are nonetheless obvious over the combination of Baum and Tsai. It would have been obvious to apply Tsai's teachings regarding the use of signal amplitude and signal phase as signal parameters to Jin's system. EX1006, Abstract, ¶8; EX1003, ¶179.

1. Motivation to Combine

A POSITA would have been motivated to apply Tsai's teaching of a signal amplitude or phase for use as one of Baum's signal parameters. EX1003, ¶¶181-186. A POSITA would have known that in estimating the channel from the transmitter to the receiver, a known amplitude and phase timing of the transmitted signal, *e.g.*, pilot, are compared with the amplitude and phase of the actually received signal. EX1003, ¶181. The differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. *Id.* The amplitude and phase information are parameters that are sent by the transmitters to the receiver to allow the receiver to differentiate the signals from each transmitter. *Id.* For example, an earlier patent assigned to Patent Owner (U.S. Patent No. 6,947,505) discloses that a parameter estimator will estimate parameters including "the received power, phase of the oscillator, timing offset relative to the base station clock carrier frequency offset, and number of multipaths," and various other parameters. EX1014, Abstract. A POSITA would understand that a known amplitude and phase timing would be sent by the transmitters to the receiver to be used by the receiver to estimate signals as it was well known in the art that a parameter estimator in "any ... highly loaded or overloaded system[]." *Id*., 1:25-32; EX1003, ¶181. Baum discloses the use of different signal parameters to identify the user for the data transmission,

including gain and phase. EX1005, 9:7-36. Tsai provides the express teaching of the well-known technique of sending the amplitude and phase parameters to the receiver and the receiver using the amplitude and phase as the signal parameter to identify a user. EX1003, ¶181.

Tsai teaches "MIMO channel estimation consists of estimating the channel gain and phase information" to differentiate signals from different devices. EX1006, ¶52. Tsai teaches the well-known technique of using successive interference cancellation to recover the transmitted data stream where the highest amplitude signal is subtracted successively. EX1006, ¶51; EX1003, ¶182. In performing this process, the signal amplitude and phase must be known and used in performing the signal identification. *Id.* A POSITA would understand that, to estimate the channel gain and phase information, the receiver must know the amplitude and phase timing of the transmitted signal and the transmitter must send the amplitude and phase parameter over the parameter channel for the receiver to use in estimating the signals. EX1003, ¶182. Tsai discloses estimating the channel gain and phase information and so discloses the "unique signal parameter comprises signal amplitude" (claim 6) and the "unique signal parameter comprises a signal phase" (claim 7).

Baum teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a OFDM system. EX1005, 3:32-34, 7:48-58, 14:54-61; EX1003, ¶183. Like Baum, Tsai discloses an OFDM system with signal amplitudes and phases. EX1006, ¶52 ("MIMO channel estimation consists of estimating the channel gain and phase information for links").

A POSITA would have been motivated to incorporate Tsai's signal amplitudes and phases with an OFDM system like Baum, to the extent they are not already incorporated in Baum's OFDM system. EX1003, ¶184. A POSITA would have known that in estimating the channel from the transmitter to the receiver, a known amplitude and phase timing of the transmitted signal, *e.g.*, pilot, are transmitted to the receiver over a parameter channel and are then compared with the amplitude and phase of the actually received signal. *Id.* These known differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. *Id.* The use of these known parameters is beneficial, as the signals inherently have these parameters and using these parameters is simple and effective. *Id.*

Given the numerous well-known benefits from using different phase and amplitudes for signals with MIMO and OFDM transmissions, a POSITA would have been motivated to incorporate Tsai's signal amplitude or phase into Baum's signal

parameter to differentiate between signals with different phases and amplitudes. EX1003, ¶184. For example, the use of signal phase and amplitude to differentiate signals would have been readily apparent to a POSITA, as it provides the benefit of distinguishing signals without requiring further processing of the signals. *Id.*

Additionally, as Baum already discloses a base station that can estimate amplitude and phases in the received signals, using the channel gain and phase in Tsai would have been a known substitute. Moreover, the sending of the amplitude and phase parameters over the parameter channel, instead of the data channel, would have been known to a POSITA as parameter channel was known to have information unique to a particular transmitting device and sending this information over a shared data channel would cause issues with disaggregating the signals. *Id.*

A POSITA would have reasonably expected this combination to succeed. EX1003, ¶185. Estimating the channel from the received phase and amplitude with the known phase and amplitude of the transmitted signal for signals with MIMO and OFDM transmissions had long been known in the field and a POSITA would have been familiar with its implementation, including as described by Tsai, estimating the channel gain and phase information. EX1003, ¶185. Estimating the channel conditions from the received phase and amplitude parameter over a parameter channel in Jin would have been well within the capabilities of a POSITA. EX1003,

¶185. Baum already discloses that the signals have known amplitude and phase parameters (EX1005, 9:7-36) and the use of these known parameters to identify the user was well known in the art as a design choice. EX1003, ¶185.

Finally, Baum, Tsai, and the '071 patent are analogous art because all three are directed to the same field of multi-user detectors, that is, simultaneously transmitting multiple types of information over a network. EX1001, Abstract; EX1005, Abstract; EX1006, Abstract; EX1003, ¶186.

2. Claim 6

Baum in view of Tsai renders obvious claim 6. EX1003, ¶187. Tsai states with MIMO and OFDM, "***MIMO channel estimation*** consists of ***estimating the channel gain*** and phase information for links." EX1006, ¶52. The channel gain in Tsai corresponds to the **signal amplitude** of the received signal. *Id.* As discussed above, it would have been obvious to a POSITA to use a signal amplitude parameter, as disclosed by Tsai, transmitted over Baum's unshared parameter channel, to differentiate different user signals. EX1003, ¶187.

3. Claim 7

Baum in view of Tsai renders obvious claim 7. EX1003, ¶188. Tsai states with MIMO and OFDM, "***MIMO channel estimation*** consists of estimating the channel gain and ***phase information for links.***" EX1006, ¶52. The phase

information in Tsai is used to determine the **signal phase** of the received signal. *Id.* As discussed above, it would have been obvious to a POSITA to use a signal phase parameter, as disclosed by Tsai, transmitted over Baum's unshared parameter channel, to differentiate different user signals. EX1003, ¶188.

VII. *FINTIV*

The Board balances six factors in considering discretionary denial. *Apple Inc. v. Fintiv, Inc.,* IPR2020- 00019, Paper 11 (PTAB Mar. 20, 2020) (precedential). To the extent the Board institutes the Samsung IPR that Petitioners seek to join, *Fintiv* is not relevant. If the Board were to consider Petitioners' petition in the first instance, the *Fintiv* factors would favor institution.

Factor 1—potential stay of the district court litigation—is neutral because Lenovo Group Ltd. ("Lenovo"), the defendant in the district court litigation, has not requested a stay. *VMWare, Inc. v. Intellectual Ventures I LLC*, IPR2020-00470, Paper 13 (PTAB Aug. 18, 2020), at 17 (finding in the absence of a stay motion that this factor "does not weigh for or against discretionary denial").

Factor 2—district court trial date and the Board's statutory deadline—weigh against denial. The Guidance Memo states that this factor weighs against denial "if the median time-to-trial is around the same time or after the projected statutory deadline for the PTAB's final written decision." EX1017. This petition is filed in

December 2024, so a final written decision would likely issue by June 2026. The median time-to-trial in the Eastern District of Texas is 22 months. EX1016. Although the Complaint against Lenovo was filed on December 12, 2023, the Complaint was not served until April 26, 2024. This unusually long delay in serving the Complaint has already once pushed back all case deadlines because Judge Gilstrap does not hold a scheduling conference until after there has been a response to the Complaint. *See* EX1018. The four-month delay in service combined with the 22-month time-to-trial statistic results in a likely February-March 2026 trial date. The date currently set for jury selection—January 5, 2026, EX1018—does not support denial where, as here, it is close in time to the final written decision, and the time-to-trial statistics and other evidence suggest that additional delays are likely. *See Dish Network v. Broadband iTV*, IPR 2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021).

Factor 3—investment in the district court proceedings—weighs heavily against discretionary denial. The associated district court case is still in the very early stages of litigation. Because Lenovo has challenged personal jurisdiction, the parties have been engaged in jurisdictional discovery, with the court's jurisdictional authority still to be decided. Even if the court has personal jurisdiction over Lenovo, a claim construction hearing is not scheduled until July 15, 2025, so a claim

construction order will not issue prior to the PTAB's projected institution decision date in June 2025. EX1018. Fact discovery will still be open, and dispositive motions and expert reports will be months away. *Id.* Accordingly, the district court will not invest significant resources or issue substantive orders related to the challenged patent prior to the issuance of an institution decision. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12.

Factor 4—overlap in the parallel proceedings—is neutral. Petitioners acknowledge that the grounds of invalidity asserted here are also asserted in the district court. But if "the Board will address the overlapping validity issues prior to the district court reaching them at trial, the Board's final written decision will simplify or fully resolve the issues for trial in the litigation," which weighs in favor of institution. *GAF Materials LLC v. Kirsch Rsch. and Dev., LLC*, IPR2021-00192, Paper 14 at 14–15 (PTAB May 25, 2021).

Factor 5—overlapping parties—is neutral because while the petitioners are different from the named defendant, Lenovo (United States) and Motorola Mobility LLC manufacture the accused products at issue in the litigation, and named defendant Lenovo Group Limited is their ultimate parent and holding company, and Patent Owner has identified Intel products as infringing.

Factor 6—other considerations—weighs against discretionary denial. None of the grounds asserted here were previously considered by either the Office or the district courts. Moreover, the '071 patent is currently asserted in a district court case. Institution of this IPR provides the opportunity for narrowing and simplifying the litigation for the district court.

Discretionary denial is also not warranted because this petition presents compelling evidence of unpatentability. As discussed above, the '071 patent admits that multi-user detectors of varying complexity were known and that parameter estimation was known. The '071 patent only purports to invent using a shared and unshared channel. However, Jin and Baum clearly teach this.

Accordingly, the Board should decline to exercise its discretion under *Fintiv* and institute trial.

VIII. DISCRETIONARY DENIAL UNDER 35 U.S.C. §325(D) IS NOT APPROPRIATE

The Board should not exercise its discretion under §325(d). Under *Advanced Bionics*, *LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, at 7 (PTAB Feb. 13, 2020), the Board employs a two-prong analytical framework: (1) whether the arguments presented in the previous action are the same or substantially the same as those previously presented to the Office; and (2) if so, whether the petitioner has demonstrated a material error by the Office in its prior

consideration of those arguments. *Id.* Within these prongs, the Board considers several non-exclusive factors from *Becton*, *Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-015786, Paper 8 (PTAB Dec. 15, 2017).

A. *Advanced Bionics* Step One

If the Samsung Petition is denied for procedural reasons, the same or substantially the same prior art or arguments will not have been previously before the Office. As an initial matter, the Jin prior art reference has never been previously considered and is a close match to the Challenged Claims of the '071 patent as detailed above. Moreover, Petitioner's arguments for Baum—the only prior art reference in this Petition previously considered by the Office—are substantially different than the arguments regarding that reference previously made before the Office.

1. Original Prosecution

None of the references relied on this Petition were previously considered by the Office during the original prosecution. This weighs heavily against denial. *Samsung Elecs. Co. v. G+ Commcn's*, *LLC*, IPR2023-00441, Paper 10, at 15-16 (PTAB Aug. 3, 2023). The references are also materially different than the references considered and cited during original prosecution because Jin and Baum disclose both a shared and unshared communication channel, which was purportedly

not found in the prior art at issue in original prosecution. Section V.B.1, *supra.; see Amperex Tech. Ltd. v. Maxell*, *Ltd*, IPR2021-01442, Paper 16, at 13-16 (PTAB Apr. 12, 2022).

Jin's and Baum's disclosure of the shared and unshared communication channel is further confirmed by Patent Owner's infringement contentions in the district court litigation, as Patent Owner has mapped the shared communication channel to the data portion of a frame and the unshared communication channel to a different frequency or time for transmitting the parameter. EX1013, 25. These are the same mappings relied on in this Petition for both references.

2. IPR2022-01233

Only the Baum reference was of record in IPR2022-01233. Section V.B, *supra*. As explained above, the PTAB denied institution in IPR2022-01233 on discretionary grounds and limited its analysis of Baum to the arguments presented in the Petition, which are different than the arguments presented here. As discussed for Step Two, this Petition relies on new arguments for Baum. Accordingly, the arguments presented here are neither the same nor substantially the same as those previously presented to the Office in IPR2022-01233, and step 1 of *Advanced Biometics* weighs against the Board exercising its discretion under 325(d).

B. *Advanced Bionics* Step Two

Because Petitioner presents new arguments and combinations in this petition, it is unnecessary to analyze step two. Regardless, the PTAB made material errors in evaluating Baum in IPR2022-01233, and this factor also weighs against the Board exercising its discretion.

1. Original Prosecution

There is no reason to proceed to step two because none of the references relied on this Petition were even cited during prosecution.

2. IPR2022-01233

While Baum was previously relied on in IPR2022-01233, this Petition relies on (1) new arguments for Baum and (2) the Board erred in its prior consideration of Baum.

This Petition relies on new arguments for Baum detailing Baum's disclosure of multi-user detection and joint detection in all embodiments. In its discretionary denial of IPR2022-01233, the Board stated that, "Petitioner apparently views the disclosures in Baum's columns 18-21 as all discussing the same embodiment, but Petitioner does not provide sufficiently persuasive support for this position." EX1012, 18. This Petition provides persuasive support detailing how all of the embodiments disclose joint detection and, even if they do not explicitly disclose joint detection, they render obvious the claims when combined. The arguments for Baum

are further supported by Patent Owner's infringement contentions in the district court litigation, as Patent Owner has mapped the shared communication channel to the data portion of a frame and the unshared communication channel to a different frequency or time for transmitting the parameter, which is the same mapping as Baum. EX1013, 25. As the Board did not previously consider Collision's infringement contentions and claim interpretation for Baum, the Board misapprehended the disclosures in Baum when it previously considered it.

Additionally, the Board erred in its consideration of Baum as it incorrectly found that Baum's embodiments do not all disclose multi-user detection. EX1012, 18. As detailed in Section VI.D, Baum discloses a multi-user detection system (referred to as "joint detection" in Baum) in all of the disclosed embodiments. For example, as detailed in this Petition, Baum discloses using joint detection with the detection scheme all of the embodiments, as it states that "diversity reception [like that disclosed in Figs. 5 and 6] is still beneficial even when joint detection is employed". EX1005, 18:6-8. Additionally, Baum discloses that "joint detection" is "referred to as multi-user detection" and all of the embodiments in Baum use multi-user detection as they are transmitting interfering signals for multiple base stations over the same shared channels. EX1005, 5:17-47, 18:1-8. The Board's previous discretionary denial erred in finding Baum does not disclose multi-user detection in

all of the embodiments as it misapprehended and overlooked the other disclosures in Baum disclosing joint detection is used in all embodiments. The Board's error was material, as the purported lack of joint detection in all embodiments of Baum was the only deficiency identified by the Board in its denial.

This Petition's new arguments on Baum and the portions of Baum relied on this Petition show the Board previously "erred in the evaluation of the prior art" as it "misapprehended or overlooked specific teachings in the relevant prior art such that the error by the Office was material to the patentability of the challenged claims." *Advanced Bionics*, IPR2019-01469, Paper 6, at 21.

IX. MANDATORY NOTICES AND FEES

A. Real Party-In-Interest

Intel Corporation, Lenovo (United States) Inc., and Motorola Mobility LLC, are real parties-in-interest and, solely because it is named as a defendant in a co-pending district court case listed below, Lenovo Group Limited is also a real party-in-interest.

B. Related Matters

Collision Commc'ns, *Inc. v. Samsung Elecs. Co. Ltd. et al.*, 2-23-cv-00587 (EDTX) (pending); *Collision Commc'ns*, *Inc. v. Lenovo Grp. Ltd.*, 2-23-cv-00594 (EDTX) (pending); *Samsung v. Collision Commc'ns*, *Inc.*, IPR2024-01248 (PTAB)

(pending); *Ericsson Inc. et al v. Collision Commc'ns*, *Inc.*, IPR2022-01233 (PTAB); *Collision Commc'ns*, *Inc. v. Telefonaktiebolaget LM Ericsson et al.*, 2-21-cv-00327 (EDTX); *Collision Commc'ns*, *Inc. v. Nokia Corp. et al.*, 2-21-cv-00308 (EDTX).

C. Counsel and Service Information

Petitioners provide the following counsel and service information. Petitioners consent to electronic service to the email addresses listed in the table below. Pursuant to 37 C.F.R. § 42.10(b), Powers of Attorney accompany this Petition.

D. Payment of Fees

Petitioners state that the fee set forth in 37 C.F.R. § 42.15(a) for this Petition has been paid by electronic funds transfer, and Petitioners further authorize payment for any additional fees from the same account.

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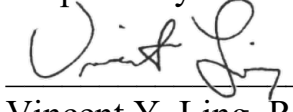
X. CONCLUSION

For the reasons above, *inter partes* review is requested.

Date: December 12, 2024

Respectfully submitted,



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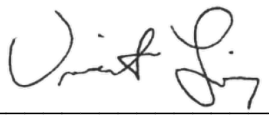
CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS, AND TYPE STYLE REQUIREMENTS

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 14,000 words, as counted using the Microsoft Word software that was used to prepare this paper, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman.

Date: December 12, 2024



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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on December 12, 2024, true and correct copies of the foregoing document and supporting materials were served in its entirety on the Patent Owner at the following address of record as listed on PAIR via Priority Mail Express® or Express Mail:

Official Correspondence Address
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Courtesy copies were also sent via electronic mail to Patent Owner's counsel of record in the related district court proceeding

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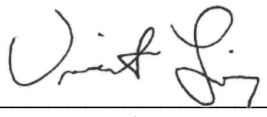

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