

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS AMERICA, INC.,  
SAMSUNG ELECTRONICS CO., LTD.,  
Petitioners,

v.

COLLISION COMMUNICATIONS, INC.,  
Patent Owner.

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Case No. IPR2024-01248  
U.S. Patent No. 9,814,071

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**DECLARATION OF PAUL S. MIN, PH.D.  
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF  
U.S. PATENT NO. 9,814,071**

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## **I. Introduction**

1. I, Paul S. Min, Ph.D., submit this declaration to state my opinions on the matter described below.

2. I have been retained by Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (“Petitioners”), as an independent expert in this proceeding before the United States Patent and Trademark Office. Although I am being compensated at my usual and customary rate of \$500 per hour, no part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding.

3. I understand that this proceeding involves U.S. Patent No. 9,814,071 (the “’071 patent”), and I have been asked to consider the validity of certain claims of the ’071 patent based on certain prior art references. I have also been asked to consider the state of the art and prior art available as of September 26, 2008. Based on the prior art discussed in this declaration, it is my opinion that claims 1-11, 16, and 21 of the ’071 patent are unpatentable for the reasons provided below.

## **II. Qualifications and Background**

4. I believe that I am well qualified to serve as a technical expert in this matter based upon my educational and work experience, and specifically, in the field of vehicle electronics and computing devices. My curriculum vitae (“CV”) is submitted as Exhibit 1015.

5. Of note, as shown in my CV, I have extensive experience design and implementation of receiver devices to be used in the cellular equipment and the WLAN equipment.

6. I received a B.S. degree in Electrical Engineering in 1982, an M.S. degree in Electrical Engineering in 1984, and a Ph.D. degree in Electrical Engineering in 1987 from the University of Michigan in Ann Arbor. I received several academic honors, including my B.S. degree with honors, a best graduate student award and a best teaching assistant award during my M.S. study, and a best paper award from a major international conference for reporting results from my Ph.D. thesis.

7. After receiving my Ph.D., I worked at Bellcore in New Jersey from August 1987 until August 1990. At Bellcore, I was responsible for evolving the public switched telephone network (POTS) into a multi-services voice and data network that incorporated packet switches, optical technologies, and wireless technologies.

8. In September 1990, I joined the faculty at Washington University in St. Louis. In July 1996, I was promoted to an Associate Professor of Electrical Engineering with tenure. I am currently a Senior Professor at Washington University of the Electrical and Systems Engineering. I have also served as the Chair of the

Graduate Curriculum (2000-2002) and the Chair of the Undergraduate Curriculum (2011-2014) for the Electrical and Systems Engineering department.

9. At Washington University, I have conducted research in communication, computing, and related electronic hardware and software. My research group has pioneered a new paradigm for designing electronic circuits that can alleviate the speed and performance mismatch against optical technology. I have received several grants from the U.S. Federal Agencies, including the National Science Foundation and the Defense Advanced Research Project Agency, and numerous contracts from companies and organizations around the world. Specifically related to the technology matters in this Investigation, I have researched a variety of wireless communication technologies, including CDMA, WCDMA, OFDM, FDD, SC-FDMA, and TDD. I have an extensive background and experience in each of these technologies.

10. As a faculty member at Washington University, I have taught a number of courses in electronics, communication, and computing at both the undergraduate and graduate levels. For example, I have taught communication theory (Washington University ESE 471), transmission and multiplexing (Washington University ESE 571), and signaling and control of communication networks (Washington University ESE 572).

11. I have supervised numerous graduate students, many of whom received a doctoral degree under my guidance. A number of doctoral theses that I have supervised relate specifically to LTE and other cellular technologies. In particular, my students and I have published a number of peer-reviewed articles on resource allocation, scheduling, modulation, mobility management, and multiplexing. Several of these articles received accolades in the field. For example, in 2011, we received a best paper award in 3G WCDMA-related mobility and resource management at the prestigious Mobility 2011 international conference.

12. In addition to my responsibilities as a university faculty member, I have founded two companies. In May 1997, I founded MinMax Technologies, Inc., a fabless semiconductor company that developed switch fabric integrated circuit chips for the Internet. In March 1999, I founded Erlang Technology, Inc., a fabless semiconductor company that focused on the design and development of integrated circuit chips and software for the Internet. One of Erlang's products received a best product of the year award in 2004 from a major trade journal for the electronics industry.

13. Outside my own start-up companies, I have also served in various technology and business advisor roles for other companies and organizations around the world. I was the main technical author for one of two winning proposals to the

Korean government for CDMA wireless service licenses (1996). I was responsible for designing a commercial scale IS-95 CDMA cellular network, which I understand to be one of the earliest such networks deployed in the world. I worked with numerous engineers and scientists around the world to implement this commercial-scale cellular network before IS-95 CDMA was widely accepted. This provided me with extensive insight into various components of CDMA technology, which by and large are used in WCDMA network. I have also been involved in a semiconductor company that specializes in semiconductor memories such as flash EEPROMs as a board member and as a technical advisor (2007-2011).

14. I am a named inventor on eleven U.S. patents, many of which are directly related to resource allocation, packet processing, and network designing. I have extensively published technical papers in international conferences and journals, technical memoranda and reports, and given a number of seminars and invited talks. Many of these papers are specifically within the context of the 3GPP standard. I have organized several international conferences and served as an international journal editor.

15. I am a member of and have been actively involved in a number of professional organizations. For example, I have served as the Chair of the Saint Louis Section of the IEEE with more than 3,000 members (2014), and a member of

the Eta Kappa Nu Honor Society for electrical engineers. I have also been an Ambassador of the McDonnell International Scholars Academy (2007-2013).

16. In my nearly 30 years of experience with telecommunications technology, I have acquired significant knowledge about telecommunications systems industry standards, standard setting organizations such as 3GPP, and the rules and document policies that those organizations have in place to develop industry standards.

### **III. Legal Standards**

17. In forming my opinions and considering the subject matter of the '268 patent and its claims in light of the prior art, I am relying on certain legal principles that counsel in this case explained to me. My understanding of these concepts is summarized below.

18. I understand that the claims define the invention. I also understand that an unpatentability analysis is a two-step process. First, the claims of the patent are construed to determine their meaning and scope. Second, after the claims are construed, the content of the prior art is compared to the construed claims.

19. I understand that a claimed invention is only patentable when it is new, useful, and non-obvious in light of the "prior art." That is, the invention, as defined by the claims of the patent, must not be anticipated or rendered obvious by the prior

art.

### **A. Claim Construction**

20. I understand that the United States Patent and Trademark Office interprets claim terms in an *inter-partes* review proceeding under the same claim construction standard that is used in a United States federal court. I understand that under this standard, the meaning of claim terms is considered from the viewpoint of one of ordinary skill in the art at the time of the alleged invention.

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

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

### **B. Anticipation Under 35 U.S.C. § 102**

23. I understand that under 35 U.S.C. § 102, a patent claim is invalid if its subject matter was patented or described in a printed publication before the effective

filing date of the claimed invention. I have been told that this is referred to as invalidity by anticipation. I have been told that a patent claim is anticipated under § 102 if a single prior art reference discloses all limitations of the claimed invention.

**C. Obviousness Under 35 U.S.C. § 103**

24. I understand that a patent claim is invalid as obvious if the claimed invention would have been obvious to a person of ordinary skill in the art (“POSITA”) at the time the claimed invention was made. This means that even if all of the elements of the claim cannot be found in a single prior art reference that would anticipate the claim, a person of ordinary skill in the field who knew about all the prior art would have come up with the claimed invention. I understand that in an obviousness determination, the person of ordinary skill in the art is presumed to have knowledge of all material prior art. I understand that whether a claim is obvious is based upon the determination of several factual issues.

25. I understand that obviousness is a determination of law based on underlying determinations of fact. I understand that these factual determinations include the scope and content of the prior art, the level of ordinary skill in the art, the differences between the claimed invention and the prior art, and secondary considerations of non-obviousness.

26. In considering obviousness, I understand that one must determine the scope and content of the prior art. I understand that, in order to be considered as prior

art to a patent being considered, a prior art reference must be reasonably related to the claimed invention of that patent. A reference is reasonably related if it is in the same field as the claimed invention or is from another field to which a person of ordinary skill in the art would look to solve a known problem.

27. I understand that one must determine what differences, if any, existed between the claimed invention and the prior art.

28. I understand that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was independently known in the prior art. In evaluating whether such a claim would have been obvious, one may consider whether a reason has been identified that would have prompted a person of ordinary skill in the art to combine the elements or concepts from the prior art in the same way as in the claimed invention. There is no single way to define the line between true inventiveness on the one hand (which is patentable) and the application of common sense and ordinary skill to solve a problem on the other hand (which is not patentable). For example, market forces or other design incentives may be what precipitated a change, rather than true inventiveness.

29. I understand that whether a prior art reference renders a patent claim unpatentable as obvious is determined from the perspective of a person of ordinary skill in the art at the time of the alleged invention. I have been told that there is no

requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, but a suggestion to combine known elements to achieve the claimed invention may come from the prior art, as filtered through the knowledge of one skilled in the art. In addition, I have been told that the inferences and creative steps a person of ordinary skill in the art would employ are also relevant to the determination of obviousness.

30. I understand that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also understand that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been told that this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

31. I understand that one may consider, e.g., whether (1) the change was merely the predictable result of using prior art elements according to their known functions, or whether it was the result of true inventiveness; (2) there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; (3) the claimed innovation applies a known technique

that had been used to improve a similar device or method in a similar way; (4) the claimed invention would have been obvious to try, meaning that the claimed innovation was one of a relatively small number of possible approaches to the problem with a reasonable expectation of success by those skilled in the art; (5) the invention merely substituted one known element for another known element in order to obtain predictable results; (6) the invention merely applies a known technique to a known device, method, or product to yield predictable results; or (7) known work in the field may have prompted variations of use of the same inventions in the same or different fields due to market forces or design incentives that would have been predictable to a person of ordinary skill in the art.

32. I understand that any assertion of secondary considerations of non-obviousness must be accompanied by a nexus between the merits of the invention and the evidence offered.

#### **IV. The '071 patent**

##### **A. Background of Technology**

33. I first begin with a summary of the technology involved with the '071 patent. In describing some of the basic concepts, I refer to a well-known text regarding wireless communications by Sergio Verdú: “Computational Complexity of Optimum Multiuser Detection,” *Algorithmica* (1989) (Ex. 1009).

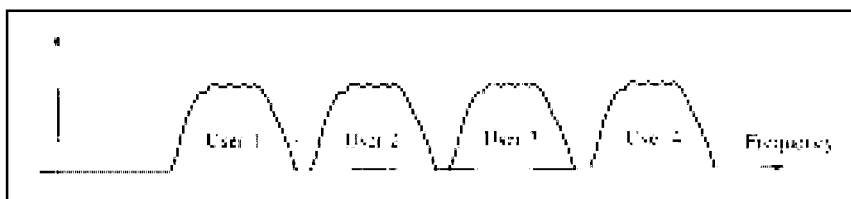
34. The '071 patent relates to the technology referred to as multiuser detection ("MUD"). MUD techniques have been well known for decades, and documented since at least the 1980s. Generally speaking, a MUD system allows users to transmit information over a shared communication path or channel. The users' information is transmitted as interfering signals over the shared communication path or channel. 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. 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. Of importance in the multiuser detection problem is that unlike the conventional multiple access mechanism, where the signals from different users are separated by the use of orthogonal channels, in the multiuser detection problem, the signals from different users cannot be separated individually, and must be decoded jointly.

35. MUD is described by Sergio Verdu in “Computational Complexity of Optimum Multiuser Detection,” *Algorithmica* (1989) (Ex. 1009). 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.” *Id.*, 304.

36. MUD has been used in many familiar wireless technologies that require sending multiple user data streams over a single signal. 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. 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. Ex. 1008, xix.

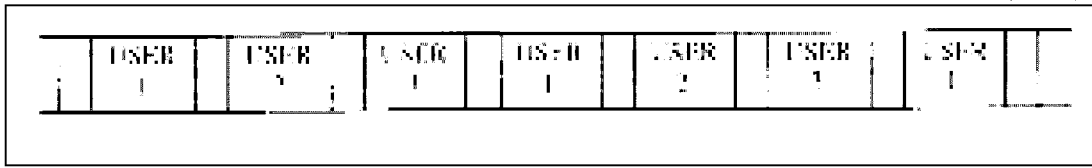
37. For example, Qualcomm pioneered the use of Code-Division Multiple-Access (“CDMA”) technology in the 1990s. In the CDMA cellular networks, multi-user detection was implemented by modulating each user’s transmitted signal using a signature waveform to identify the data that belonged to each user in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

38. Another system pioneered by Qualcomm in the 1990s was Frequency Division Multiplexing or Frequency Division Multiple Access (“FDMA”). 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.* This is shown below:



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

40. Yet another system in use in the 1990s was Time Division Multiplexing (“TDMA”) systems. 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. 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. This is shown below:



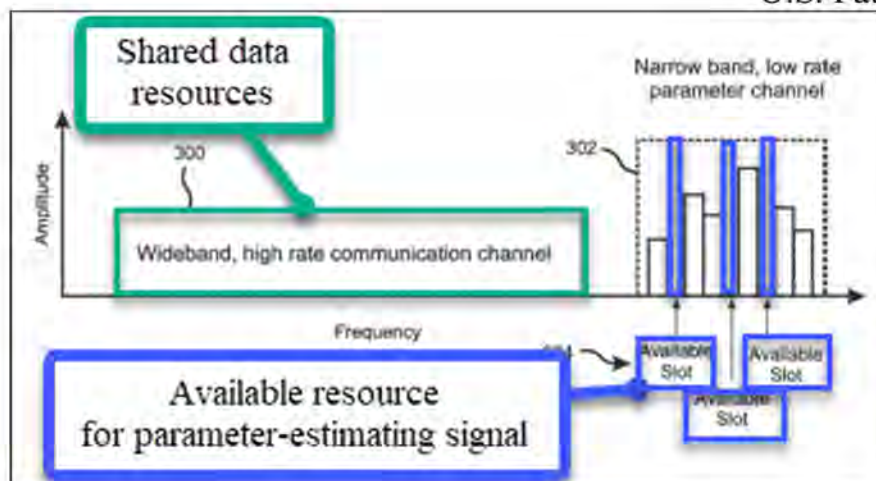
41. As shown in the above figure, each user has a signal parameter based on time division. The receiver can use this time division to demodulate the signal and correlate it to the user.

42. In the above CDMA, FDMA and TDMA systems, it was critical to correlate data streams to users. All of these systems employed MUD, and specifically, utilized parameters to identify the user that corresponds to the data sent over the shared channel. 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. 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. 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. Ex. 1009, 304. 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.

#### **B. Overview of the '071 patent (Ex. 1001)**

43. The '071 patent is directed to detecting data for users transmitted over a shared communication channel using signal parameters to distinguish transmitted user data. Ex. 1001, 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 a single user instead of being shared among all of the users. *Id.*

44. 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). Ex. 1001, 8:27-30.



45. 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.

### C. Prosecution History of the '071 patent

46. I have reviewed the prosecution history of the application that led to the '071 patent. Ex. 1002. I have provided a summary below of the prosecution history.

#### 1. Original Prosecution History

47. The claims were initially rejected as anticipated by U.S. Patent Application Publication No. 2006/0114826 ("Brommer"). Ex. 1002, 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. Ex. 1002, 250 (emphasis added).

48. 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**

49. I have reviewed the prior *inter partes* review (“IPR”) request filed by Nokia Corp. (“Nokia”) and Ericsson Inc. (“Ericsson”) on July 20, 2022 and provide a summary of this IPR below.

50. On July 20, 2022, Nokia and Ericsson filed a petition for IPR challenging 1-10, 13, 14, 16, and 21 of the ’071 patent. Ex. 1010, 8. In the petition, Nokia and Ericsson asserted the following invalidity grounds:

| <b>Claims</b>            | <b>Prior Art Combination Under 35 U.S.C. § 103</b>                                                 |
|--------------------------|----------------------------------------------------------------------------------------------------|
| 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”)                                                                 |

51. On January 19, 2023, the Board exercised its discretion under 35 U.S.C. §314(a) to deny the petition because the co-pending district court litigation was in an advanced stage and the parties already had invested significantly in the Eastern District of Texas litigation. Ex. 1012, 10-19. The Board analyzed the merits of the petition in considering whether the petition would “plainly” result in a conclusion of unpatentability. *Id.*, 17-18. The Board found that the Kim ground would not plainly lead to a conclusion of unpatentability as the petition relied on different channel and data for “distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters” limitation. *Id.*, 17. 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, however, did not analyze the merits of the various Baum embodiments and, therefore, did not provide a “roadmap” for the use of Baum.

**D. Person of Ordinary Skill in the Art**

52. I am informed that patentability must be analyzed from the perspective of “one of ordinary skill in the art” in the same field as the ’071 patent at the time of the invention. As previously discussed, the relevant time of invention is the patent’s priority date, which is no earlier than September 26, 2008. Moreover, I understand that whether or not a patent application provides “written description” support for patent claims must also be assessed from the perspective of a person of ordinary skill in the art.

53. I am also informed that several factors are considered in assessing the level of ordinary skill in the art, including (1) the types of problems encountered in the art; (2) the prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the education level of active workers in the field.

54. A person of ordinary skill in the art pertinent to the ’071 patent would have 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. Additional education could substitute for professional experience and vice versa. A person of ordinary skill in the art would also be able to understand and apply the prior art discussed herein.

55. Although I surpass this definition of one of ordinary skill in the art now and at the priority date of the '071 patent, my analysis regarding the '071 patent has been based on the perspective of one ordinary skill in the art as of the priority date of the '071 patent.

56. I am also familiar with the knowledge of the person of ordinary skill in the art as of the priority date of the '071 patent. I am able to opine on how the person of ordinary skill in the art would have understood the disclosure and claims of the '071 patent, the disclosures of the prior art, the motivation to combine the prior art, and what combinations would have been obvious to one of ordinary skill in the art.

#### **V. Claim Construction of Terms of the '071 patent**

57. As I discussed above, I have been informed that for purposes of *inter-partes* reviews, the standard for claim construction of terms within the claims of the patent is the same as that applied in federal district court litigation. I have been asked to assume that the claim terms otherwise have their plain and ordinary meaning to a person skilled in the art in light of the specification and the prosecution history.

58. As of this time, I am not aware of any term that requires specific construction for my opinions. To the extent Patent Owner suggests a narrow construction for a term, I reserve the right to respond to those opinions.

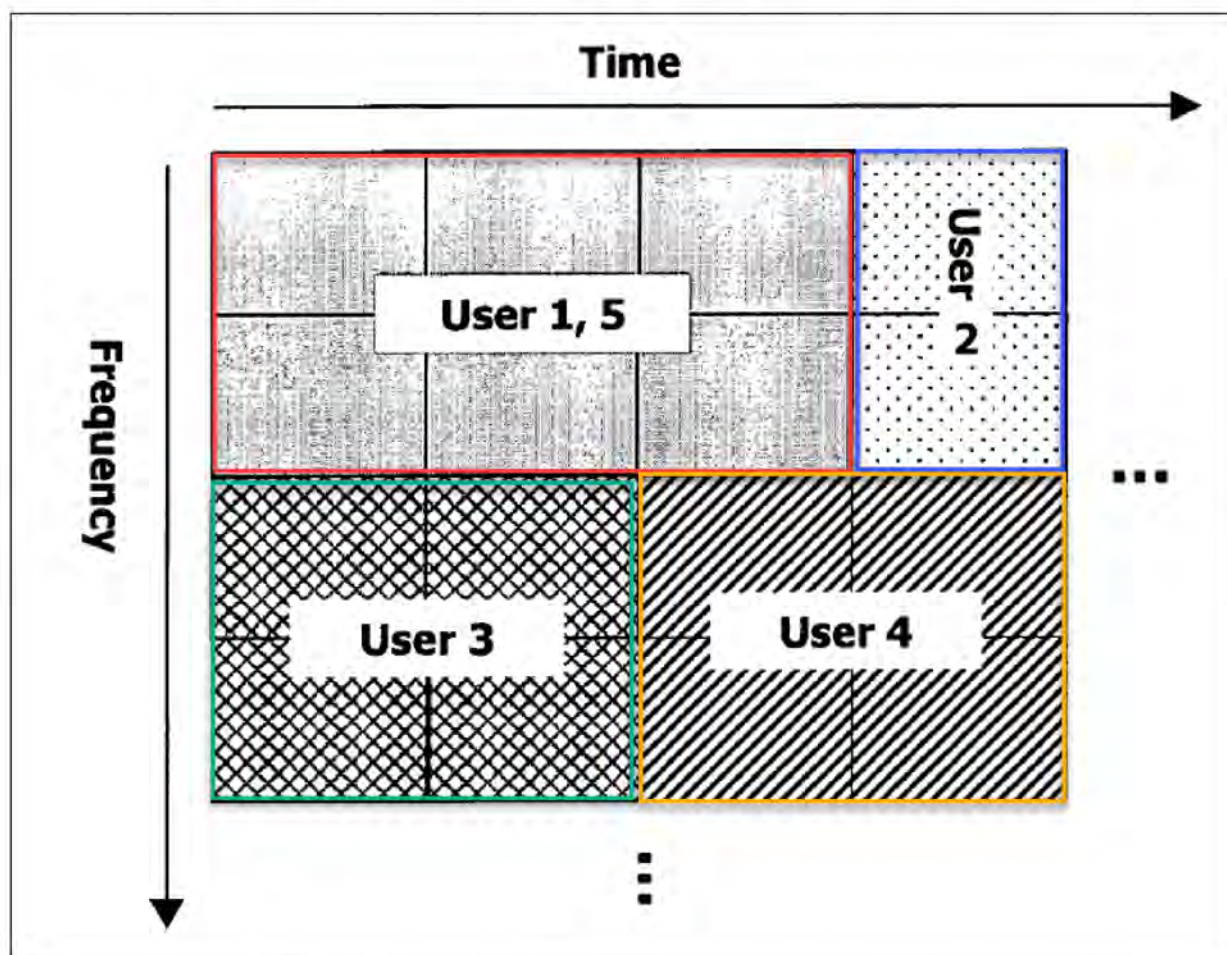
#### **VI. Overview of Prior Art**

59. Below, I discuss the references I rely on in my declaration.

**A. Jin (Ex. 1004)**

60. U.S. Pat. Pub. No. 2005/0286408 (“Jin”) (Ex. 1004) was filed on June 23, 2005 and published on December 29, 2005. I understand it is prior art.

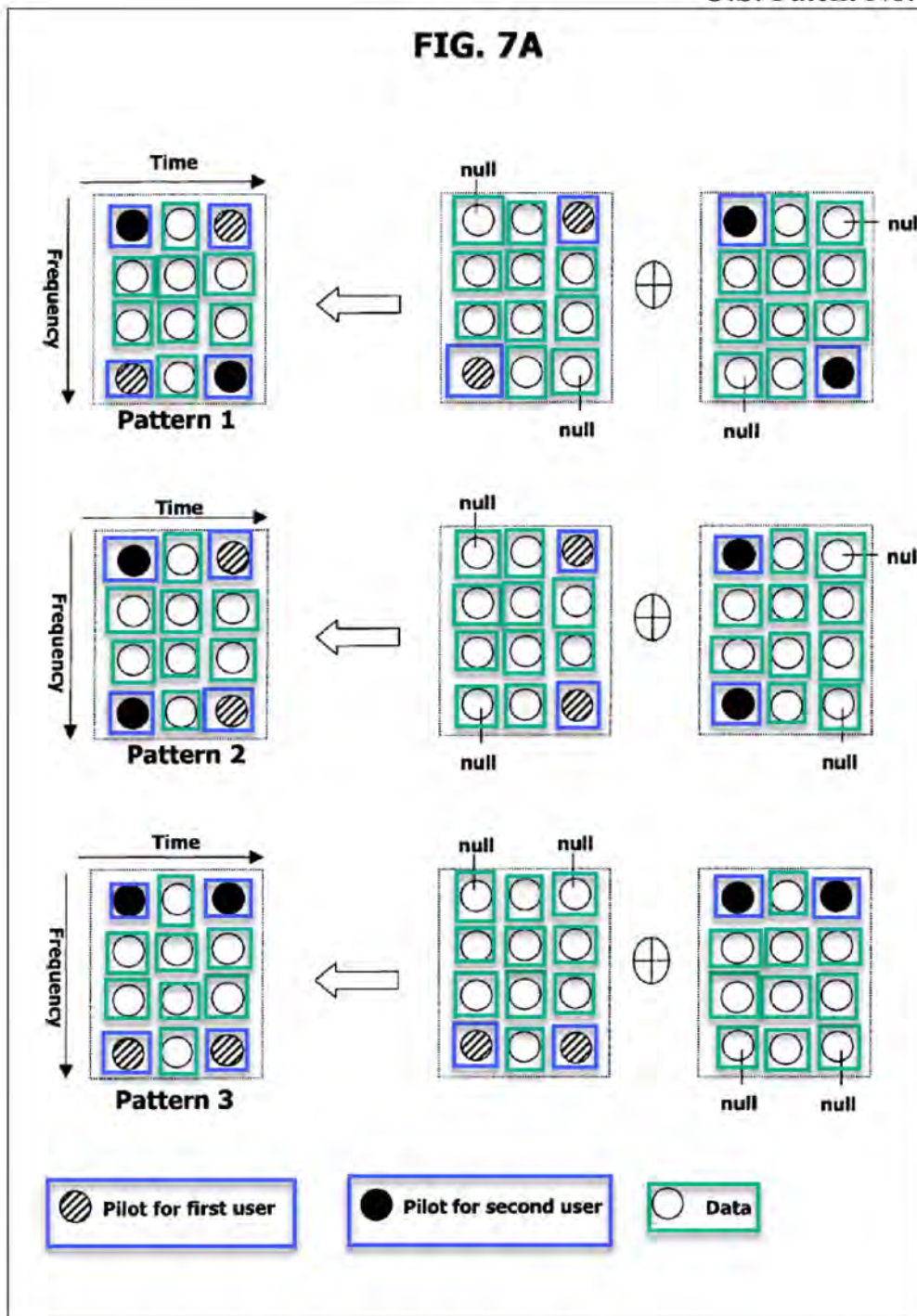
61. Jin discloses a multi-user detection system where users 1 and 5 are transmitting on the same shared channel in an OFDM (Orthogonal Frequency Division Multiplexing) wireless network, for example in Figure 5 (annotated below):



Specifically, Jin discloses an OFDM network where a single data stream is split among several closely spaced narrowband subchannel frequencies instead of a

single wideband channel frequency. In an OFDM like the one disclosed in Jin, the subchannel frequencies can be shared with other users or unshared depending on the allocation of the frequency and time.

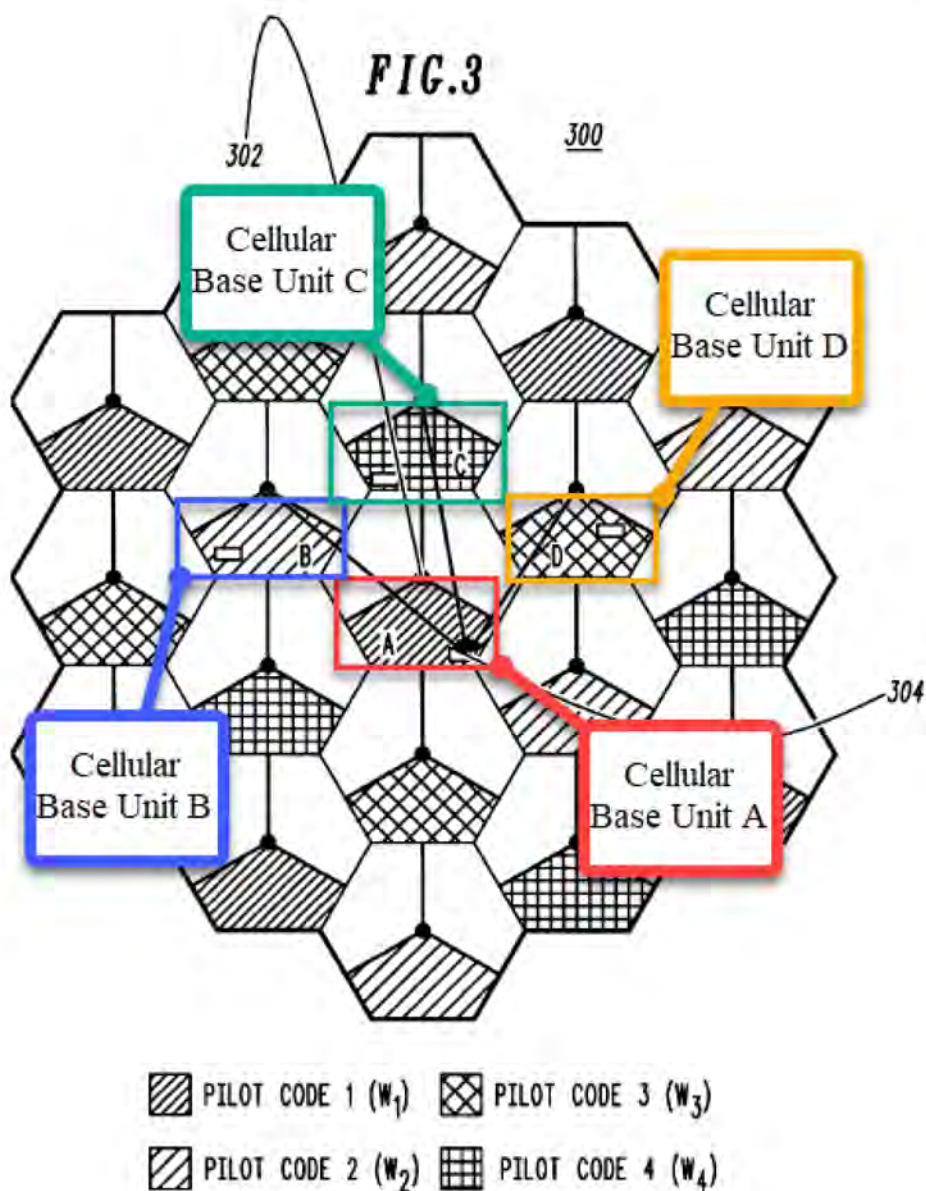
62. Jin discloses identifying the data for user 1 and user 5 by using signal parameters that are sent on an unshared communication channel. For example, Jin discloses “analyz[ing] a pilot pattern of the basic allocation unit received over the uplink to identify which user (i.e., mobile terminal) has transmitted the received data [by] ... identif[ying] whether the received data is from user 1 or user 5 by analyzing the pilot pattern included in the basic allocation unit.” Ex. 1004, ¶¶ 56, 72. Jin discloses each of the pilots is the “parameter channel” and the data is the “shared communication channel”:



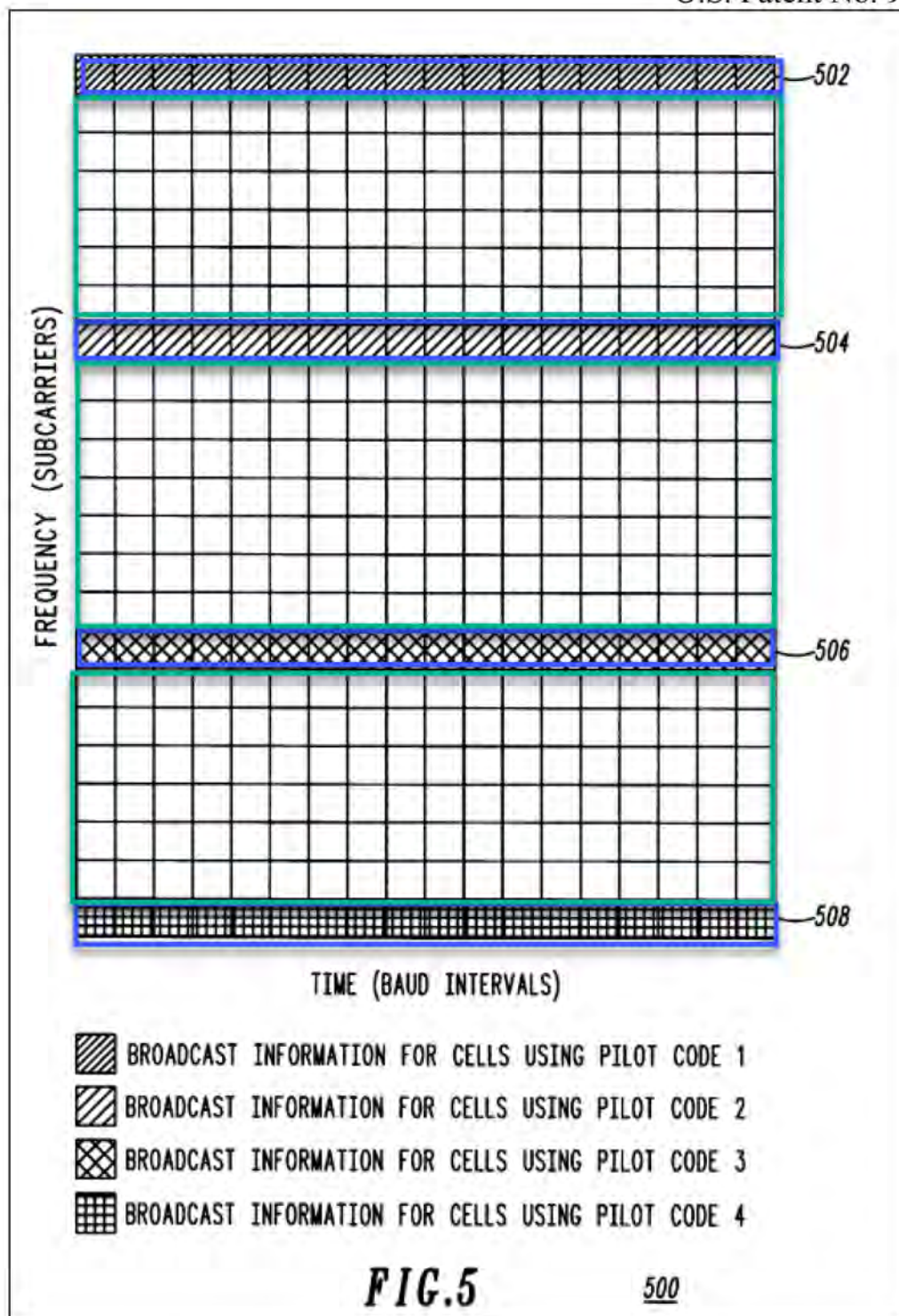
B. Baum (Ex. 1005)

63. U.S. Pat. No. 5,867,478 (“Baum”) (Ex. 1005) was filed on June 20, 1997 and issued on February 2, 1999. I understand it is prior art.

64. Baum discloses a prior art MUD system. Ex. 1005, 5:17-47, 18:1-8. Baum discloses a cellular network with four base units in sectors A, B, C, D, respectively, which each transmit over a shared and unshared communication channel.



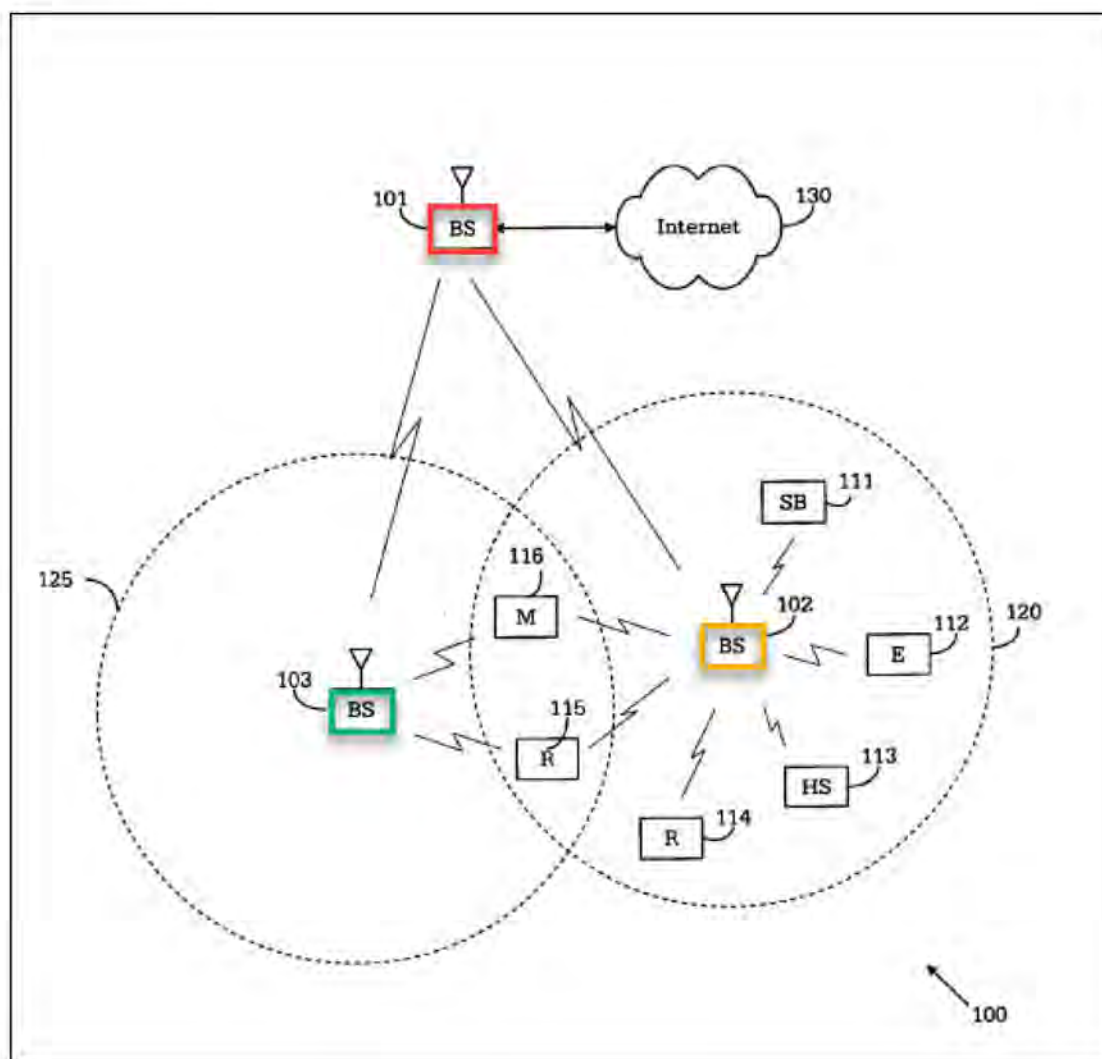
65. Baum discloses a synchronization signal sent on the unshared “parameter channel” for identifying the user for the data that is sent on the “shared communication channel”:



C. Tsai (Ex. 1006)

66. U.S. Pat. Pub. No. 2010/0054200 ("Tsai") (Ex. 1006) was filed on August 26, 2008 and published on March 4, 2010. I understand it is prior art.

67. Tsai discloses a multi-user detection system and method where multiple base stations transmit data over shared and unshared communication channels. Ex. 1006, ¶¶30-33. Tsai shows an exemplary network with base stations BS 101, BS 102, and BS 103.



68. Tsai discloses that the system is a multiple-input and multiple-output (“MIMO”) system. Ex. 1006, ¶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.

**D. Vrzic (Ex. 1007)**

69. U.S. Pat. Pub. No. 2014/0161068 (“Vrzic”) (Ex. 1007) was filed on April 21, 2008 and published on June 12, 2014. I understand it is prior art.

70. Vrzic discloses a multi-user detection system and method where multiple base stations transmit data over shared and unshared communication channels. Ex. 1007, ¶¶21. Tsai shows an exemplary network with base stations BS 16, BS 16, and BS 16.

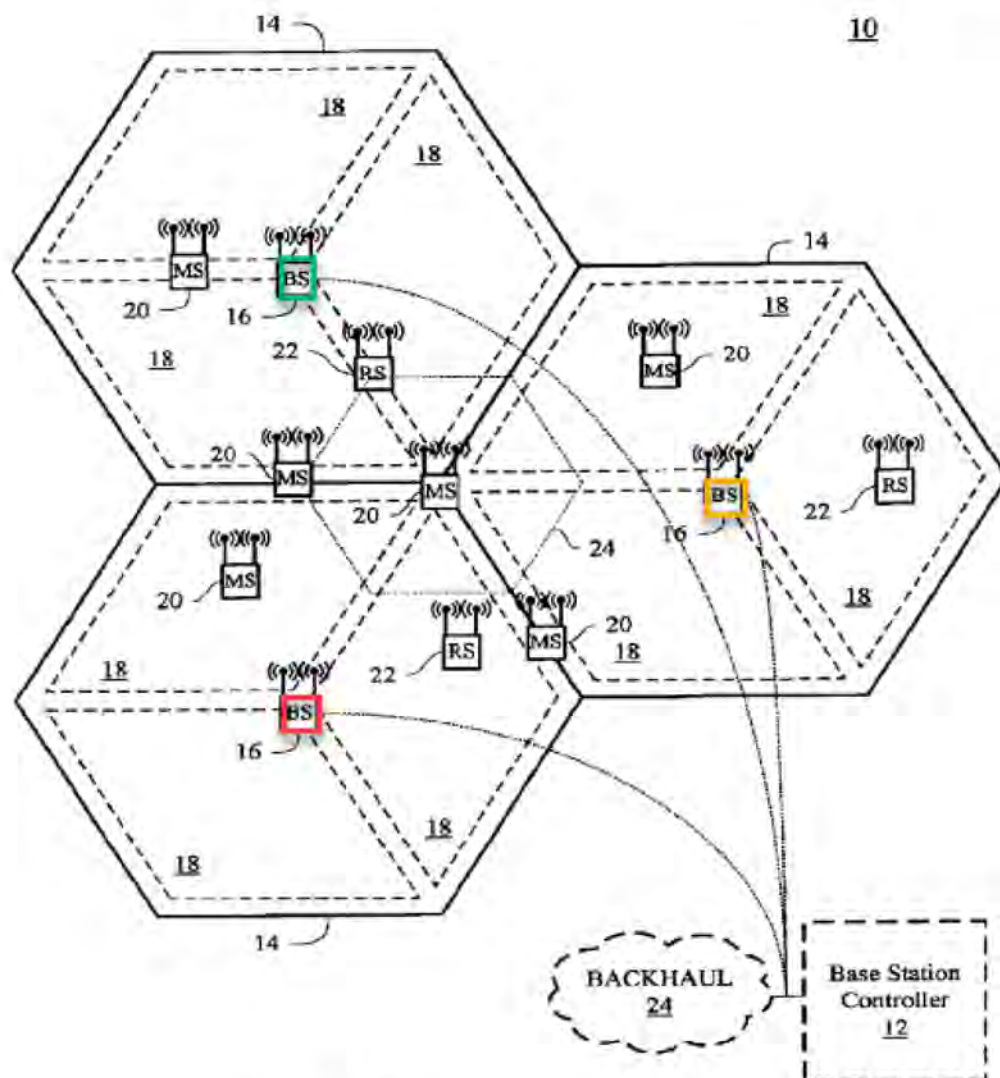


**FIG. 1**

71. Vrzic discloses that the system is a MIMO system and uses “synchronization logic” to identify the user for the data transmitted over the shared communication channel and 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. Ex. 1007, ¶41.

## VII. Summary of Opinions on Unpatentability

72. In the analysis that follows, I identify the following combinations of prior art that, in my opinion, anticipate and/or render obvious the '071 patent claims:

| 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          |

### A. Ground 1: Claims 1-11, 16, 21 are Rendered Obvious by Jin under Section 103

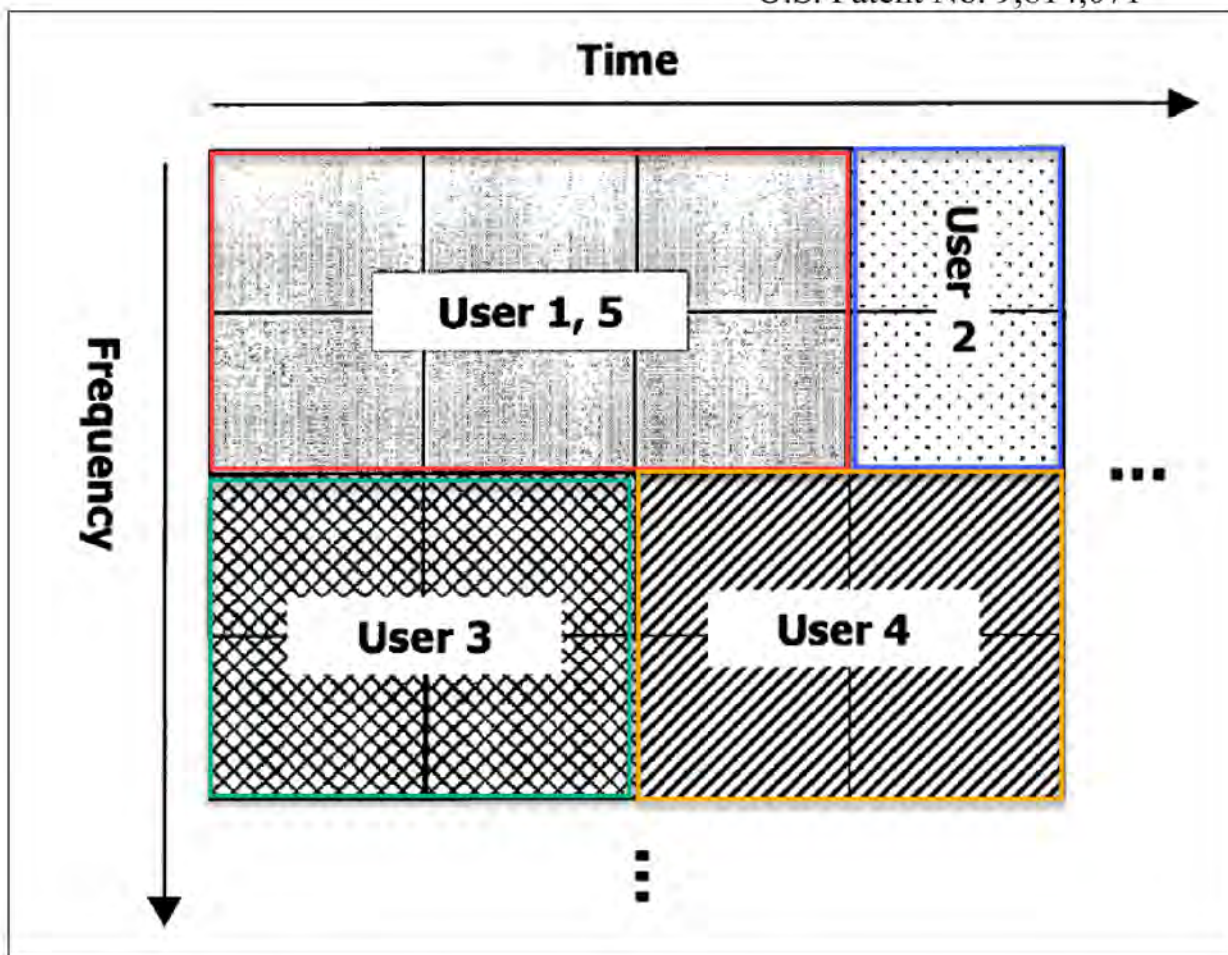
73. I provide a summary of this ground as follows. Jin, like the '071 patent, discloses multi-user detection using shared and unshared channels. Ground 1 addresses claims 1-5, 10, 11, 16, and 21 because Jin discloses every limitation of the claims. Nevertheless, Ground 1 is presented as an obviousness ground to address potential arguments Patent Owner may present.

1. **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:**

74. In my opinion, Jin discloses this limitation, to the extent the preamble is limiting.

75. With respect to the element “*a method for enabling a receiving node to distinguish information simultaneously received*,” Jin discloses the base station (*i.e.*, “**receiving node**”) receives the information simultaneously transmitted from mobile terminals for 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] ... identif[ying] 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**”). Ex. 1004, ¶¶32, 56, 72. As the receiver is receiving the data from multiple users at the same time, a POSITA would understand that it uses the pilot patterns to distinguish the information for each user.

76. With respect to the element “*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:



77. A POSITA would understand that the wireless communication network in Jin with at least five mobile terminals, one for each user, which are transmitting is the claimed from a plurality of transmitting nodes.

78. With respect to the element “*transmitting ... on a shared communication channel*,” Jin discloses 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.” Ex. 1004, ¶¶ 32, 56.

79. Additionally, I have reviewed Patent Owner’s infringement contentions in the district court case and I understand that Patent Owner has mapped the shared communication channel to the data portion of a frame. Ex. 1013, 25. Patent Owner’s infringement contentions rely on the same radio resource allocation disclosure to mee this claim element.

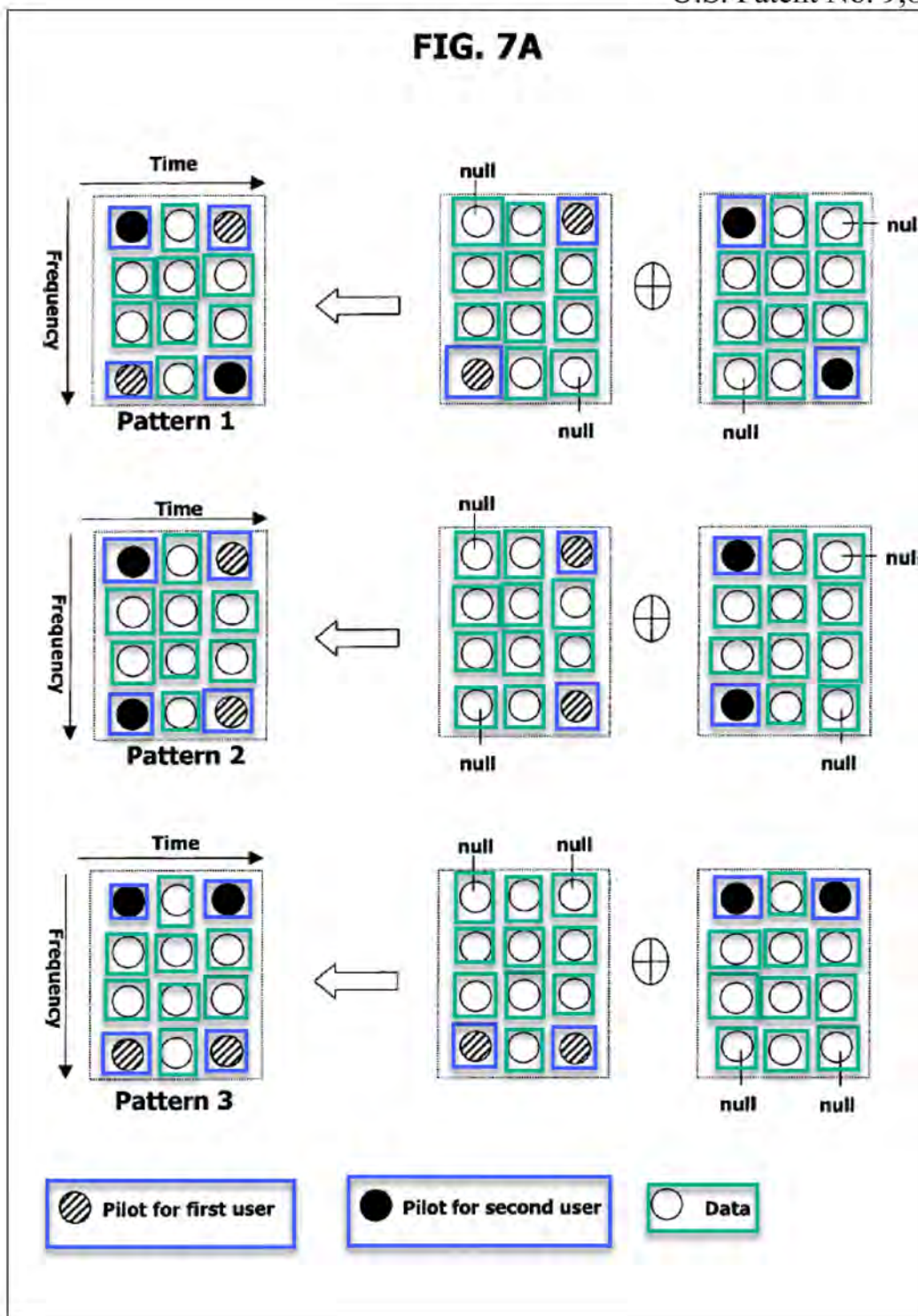
80. With respect to the element “*of a wireless digital network*,” Jin discloses “a wireless communication system” that uses digital modulation as it is “an OFDM/OFDMA system” (“**wireless digital network**”). Ex. 1004, ¶¶ 32, 56.

(a) **1a: providing a plurality of parameter channels on the network in addition to the shared communication channel;**

81. In my opinion, Jin discloses this limitation.

82. Jin discloses a plurality of parameter channels on the network as it uses “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**”). Ex. 1004, ¶¶ 73-76. The “pilot” (or more precisely “pilot signal”) is a widely used term in the communication field. The pilot signals are known signals that can be used to help receiving other signals such as the user data. To achieve this, receiving the pilot signals must be easier and more reliable than receiving other signals, and this is done by assigning known signal patterns to the pilot signals. In Jin, the pilots occupy different regions of time and/or frequency in a frame, which allows the base station

to measure or monitor each synchronization signal without co-channel interference (*i.e.*, “**in addition to the shared communication channel**”). *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.*” Ex. 1004, ¶ 74. 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” comprising the time and frequency positions that are not allocated to the pilots:



83. 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 compensat[e] the channel, and applies it to a method for dividing data of users.” Ex. 1004, ¶ 78. In my opinion, a POSITA would understand that this measuring, compensating and applying [the channel] to a method for dividing data of users, is used to estimate parameters. 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. Ex. 1013, 25.

**(b) 1b: requiring each transmitting node to transmit a parameter-estimating signal on an unshared said parameter channel;**

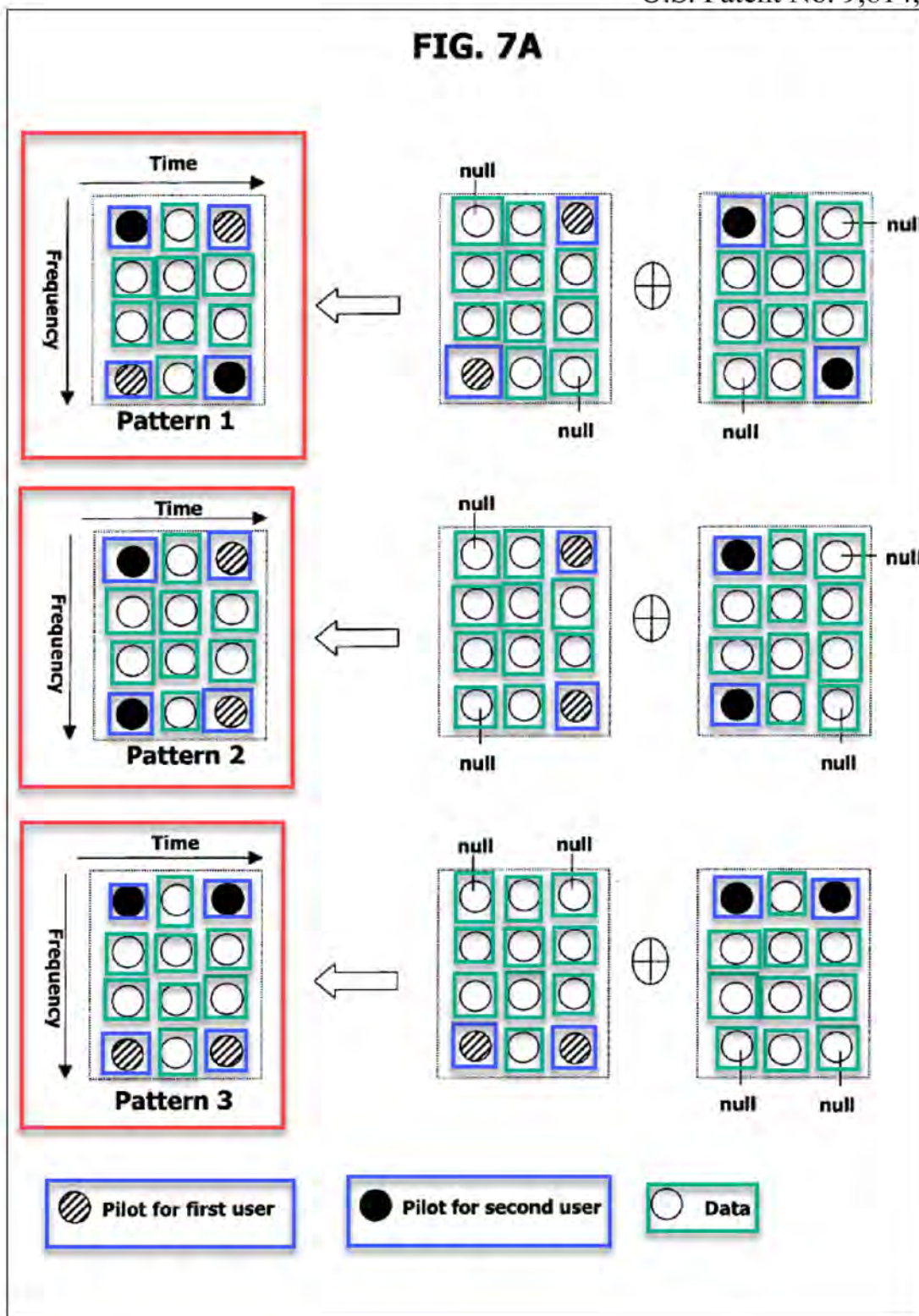
84. In my opinion, Jin discloses this limitation.

85. 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 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**”). Ex. 1004, ¶¶73-76, 86, Fig. 7A. 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.” Ex. 1004, ¶72. The 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.” Ex. 1004, ¶¶ 77,78. In my opinion, a POSITA would understand that this measuring, compensating and applying [the channel] to a method for dividing data of users, is used to estimate parameters.

86. This can be seen in Fig. 7A, as the pilot patterns are transmitted on the unshared “parameter channels”:

**FIG. 7A**



- (c) **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;**

87. In my opinion, Jin discloses this limitation.

88. With respect to the element “*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 each pilot subchannel corresponds to each user (*i.e.*, “**unshared parameter channels**”). Ex. 1004, ¶¶73-76, Fig. 7A. 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.” Ex. 1004, ¶72. 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.*

89. With respect to the element “*estimating ... at least one unique signal parameter for each of the transmitting nodes*,” Jin discloses estimating at least one unique pilot parameter (*i.e.*, “**unique signal parameter**”) for each user (*i.e.*, “**transmitting node**”). Ex. 1004, ¶¶73-76, Fig. 7A. 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.” Ex. 1004, ¶¶72, 78. The phase differences and radio channel parameters are signal parameters of the pilot. *Id.*

(d) **1d: detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.**

90. In my opinion, Jin discloses this limitation.

91. 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.” Ex. 1004, ¶¶72, 74. 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.” Ex. 1004, ¶¶55, 78. 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” 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.” Ex. 1004, ¶¶72, 78. Thus, Jin teaches “**detecting and distinguishing**” the received information.

**3. Claim 2: The method of claim 1, wherein said providing a plurality of parameter channels comprises using channel-spreading technology.**

92. In my opinion, Jin discloses this claim.

93. 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**”). Ex. 1004, ¶75. 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. Ex. 1001, 2:42-60.

**4. Claim 3: The method of claim 2, wherein said channel spreading technology comprises at least one of FDMA, TDMA, CDMA, and SDMA.**

94. In my opinion, Jin discloses this claim.

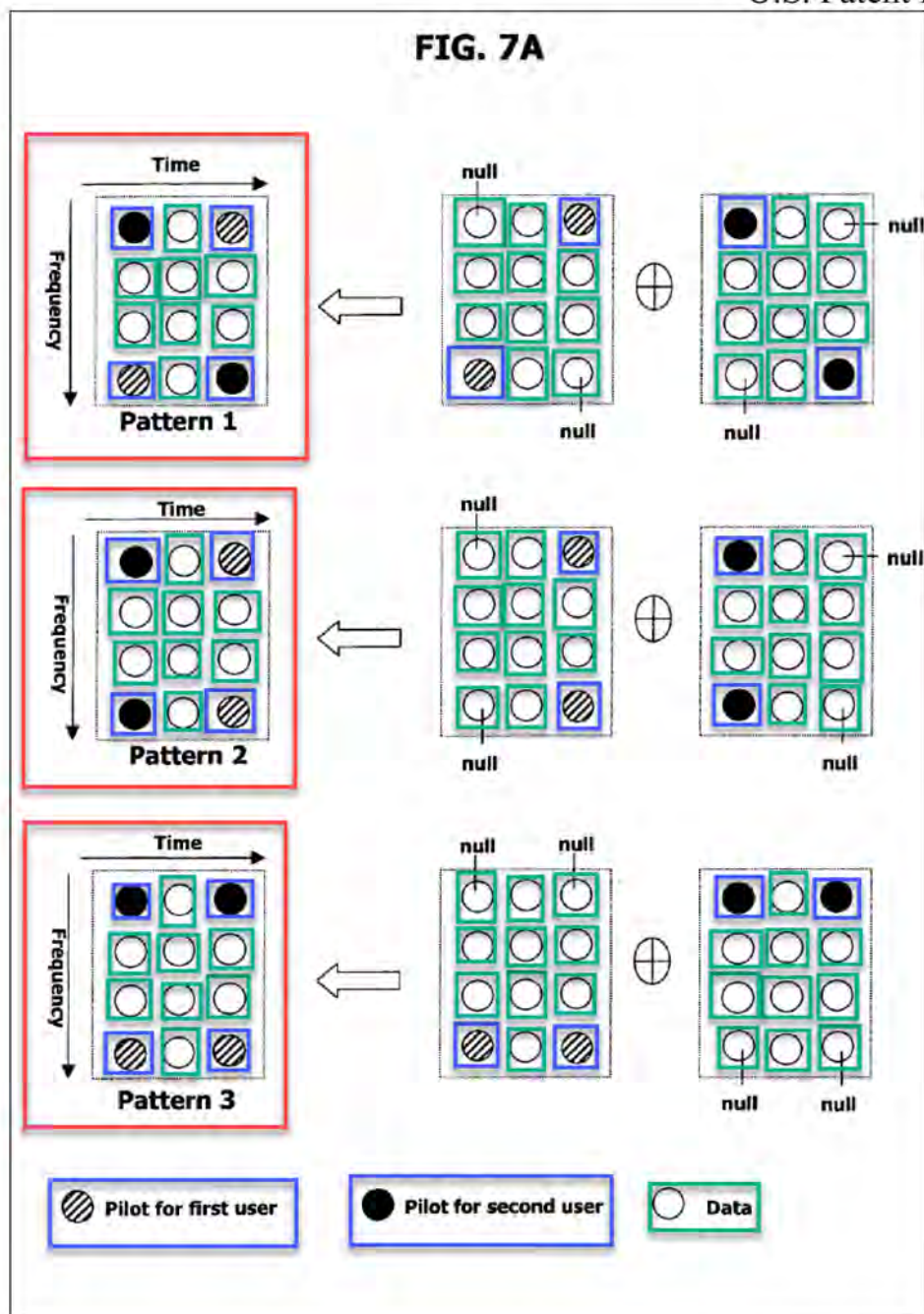
95. Jin discloses using time division (“**TDMA**”) and frequency division (“**FDMA**”) to provide a plurality of parameter channels. Ex. 1004, ¶¶73-75.

**5. Claim 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.**

96. In my opinion, Jin discloses this claim.

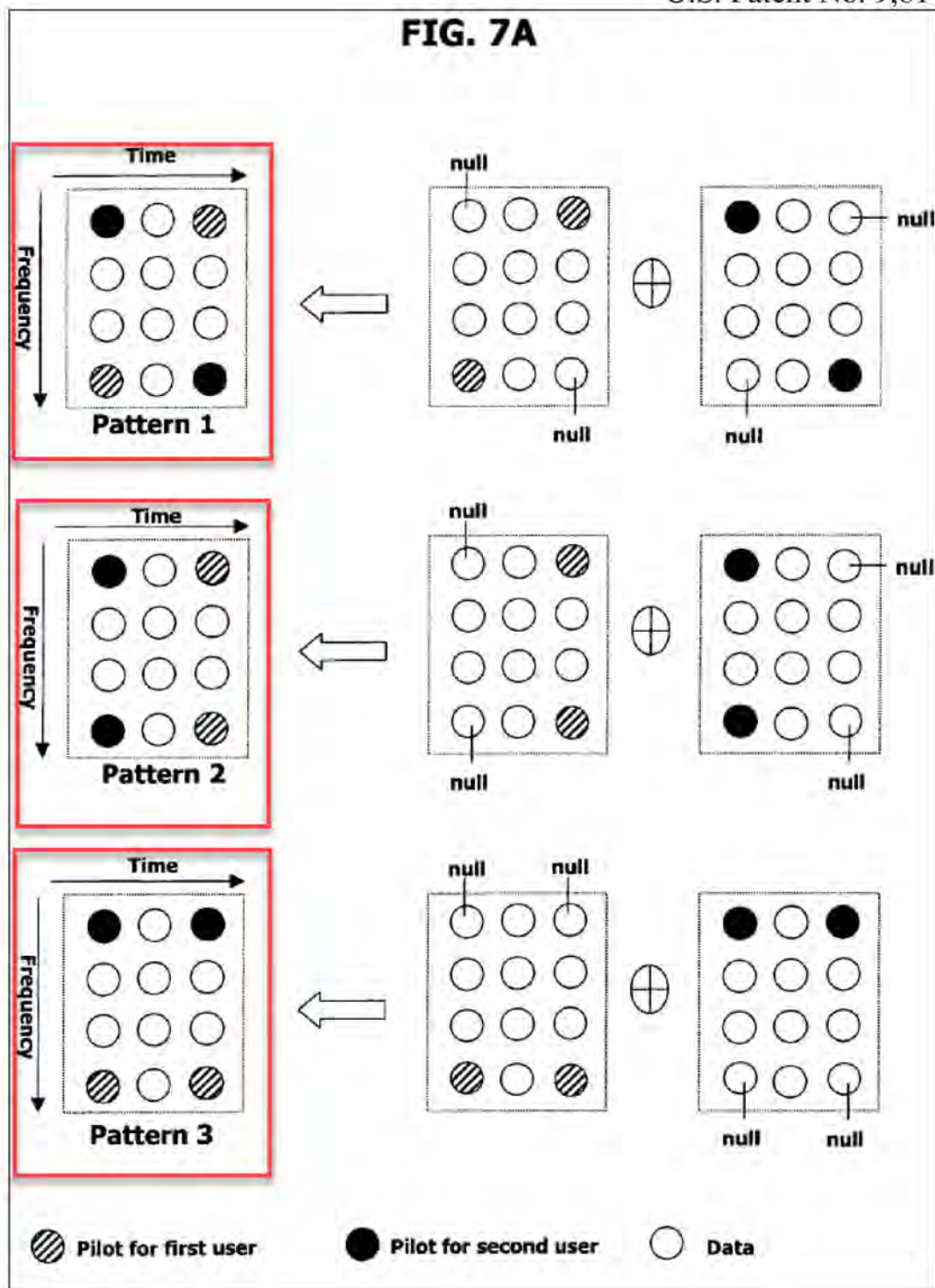
97. Jin discloses each user (*i.e.*, “**transmitting node**”) transmits the pilot pattern (*i.e.*, “**parameter-estimating signal**”) while **simultaneously transmitting** data (*i.e.*, “**information**”) on the data subcarrier (*i.e.*, “**shared communication channel**”). Ex. 1004, ¶72. Jin discloses “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.” Ex. 1004, ¶¶55, 78. This is shown in Fig. 7A, where the data and the pilot pattern are transmitted simultaneously:



6. **Claim 5:** The method of claim 1, wherein the parameter-estimating signal is a parameter-estimating symbol pattern.

98. In my opinion, Jin discloses this claim.

99. 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. Ex. 1004, ¶7. This means that each of the time and frequency position in an OFDM/OFDMA frame disclosed in Jin carries a symbol, which is a signal carrying one or more bits of information. As such, the pilots, each occupying one symbol time unit and one frequency subchannel, disclosed in (*i.e.*, “**parameter-estimating signal**”) is a symbol pattern as it “analyzes *a pilot pattern*” (*i.e.*, “**a parameter-estimating symbol pattern**”) “of the basic allocation unit received over the uplink to identify which user (*i.e.*, mobile terminal) has transmitted the received data ... by *analyzing the pilot pattern* included in the basic allocation unit.” Ex. 1004, ¶72. Additionally, Fig. 7A shows the **pilot pattern** as a “symbol pattern”:



**7. Claim 6: The method of claim 1, wherein the at least one unique signal parameter comprises signal amplitude.**

100. In my opinion, Jin discloses this claim.

101. Jin discloses the use of different signal parameters to identify the user for the data transmission, including amplitude (*i.e.*, “signal amplitude”). Ex. 1004, ¶77. Jin discloses that the base station uses the pilot signal amplitude value as a unique pilot parameter (*i.e.*, “unique signal parameter”). *Id.*

**8. Claim 7: The method of claim 1, wherein the at least one unique signal parameter includes a signal phase.**

102. In my opinion, Jin discloses this claim.

103. Jin discloses the use of different signal parameters to identify the user for the data transmission, including phase (*i.e.*, “**signal phase**”). Ex. 1004, ¶77. 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.*

**9. Claim 8: The method of claim 1, wherein the at least one unique signal parameter includes a signal carrier frequency offset.**

104. In my opinion, Jin discloses this claim.

105. 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**”). Ex. 1004, ¶¶70, 75. 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.*

**10. Claim 9: The method of claim 1, wherein the at least one unique signal parameter includes a signal relative time delay.**

106. In my opinion, Jin discloses this claim.

107. 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**”). Ex. 1004, ¶¶70, 75. 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.*

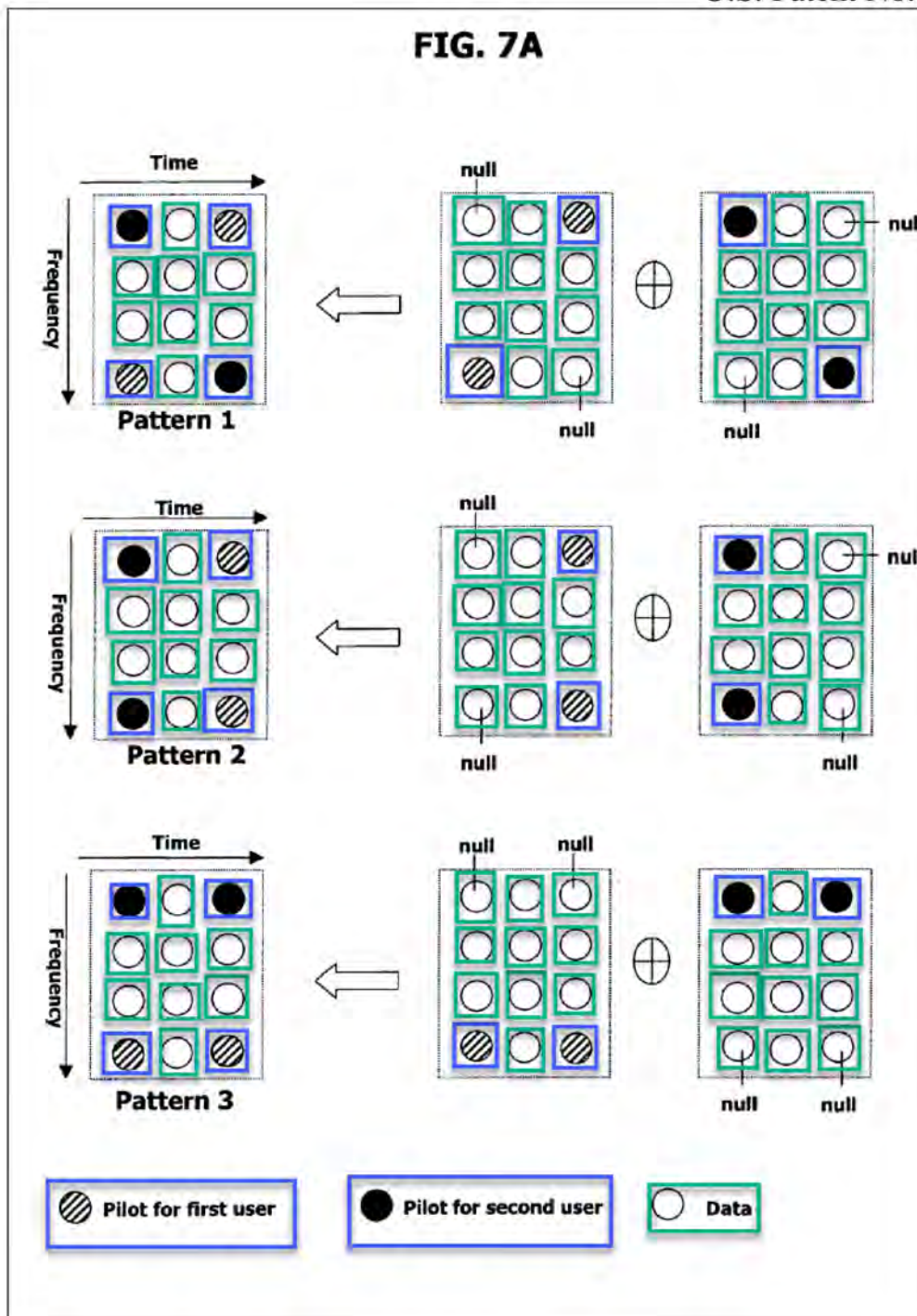
**11. Claim 10: The method of claim 1, further comprising requiring each transmitting node to transmit node identifying information on the unshared parameter channel.**

108. In my opinion, Jin discloses this claim.

109. 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**”). 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.” Ex. 1004, ¶¶72, 74. In my opinion, a POSITA would understand that this is possible because in Jin,

different users transmit their respective pilot signals at different time and frequency positions, as well as use different pilot signals. *Id.* Jin discloses 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.* Jin discloses the pilot signal is 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.” Ex. 1004, ¶78.

110. 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”:



**12. Claim 11: The method of claim 1, further comprising requiring each transmitting node to transmit spreading code type information on the unshared parameter channel.**

111. In my opinion, Jin discloses this claim.

112. 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**”). Generally speaking, “spreading code” is a sequence of symbols used in the Code Division Multiple Access (CDMA), wherein different spreading codes are used to differentiate signals from different users. The ’071 patent, however, describes the TDMA and FDMA, as well as the CDMA as the spreading technology. See, e.g., Ex. 1001, 4:52-56. Accordingly, 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.” Ex. 1004, ¶75. In addition, Jin discloses “[the] control parameters comprise orthogonal pilot pattern indicators for using orthogonal pilot patterns associated with supporting at least concurrent dual transmission by at least one mobile station,” and “[t]he orthogonal pilot patterns comprises at least a minus pilot being used for an uplink basic allocation unit. The mobile station then transmits uplink data to the base station by using the Orthogonal pilot patterns.” Ex.

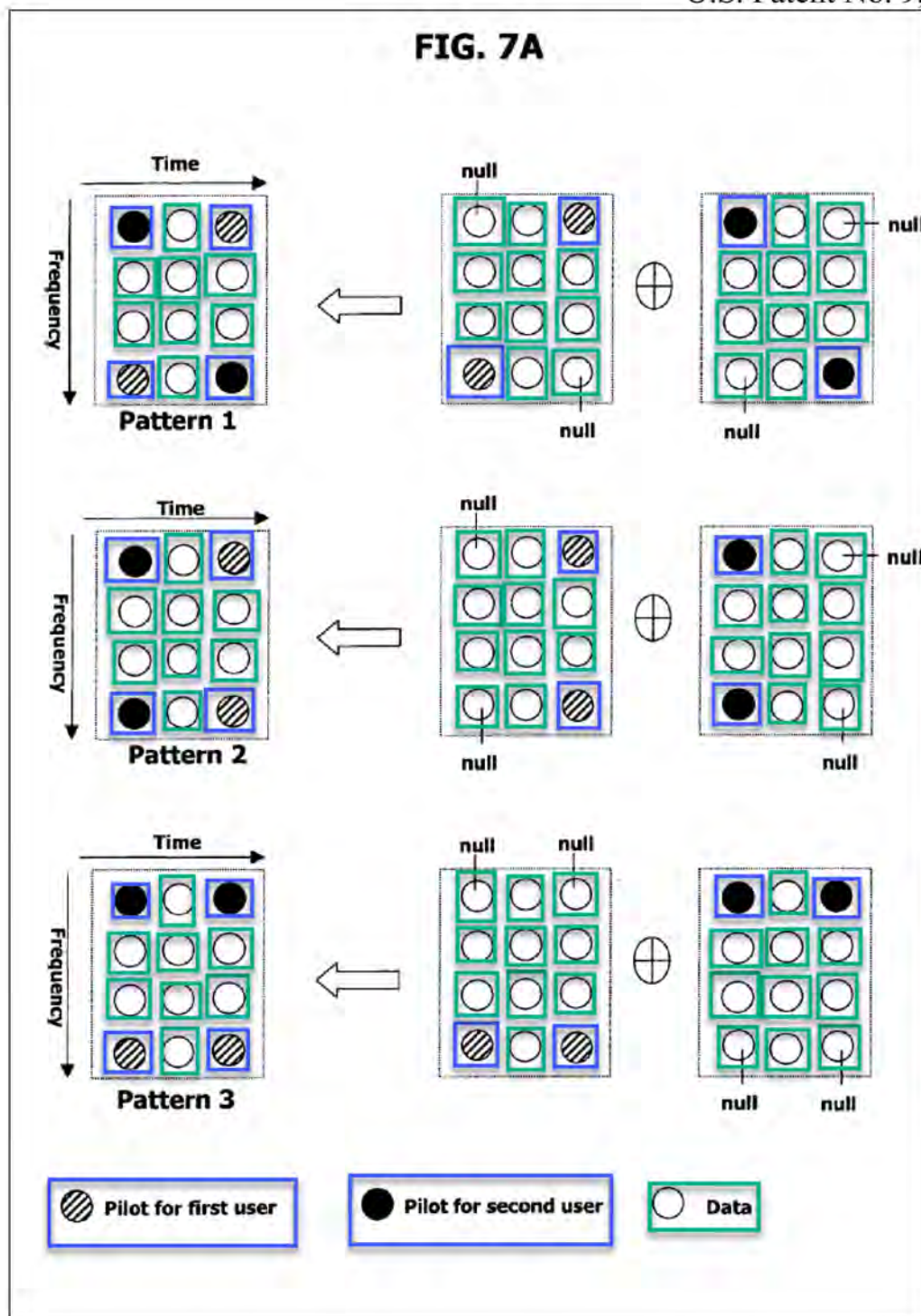
1004, Abstract. These excerpts from Jin explains that a mobile terminal can transmit a minus pilot pattern (i.e., 180 degree rotation for the complex value of the original pilot signal), which indicates to the base station that the transmitted pilot signal is a different type of pilot, i.e., a minus pilot signal as opposed to the original orthogonal. In my opinion, a POSITA would have known that by indicating the different types of pilot signal, the receiver, i.e., the base station, would know additional information (e.g., high priority versus low priority) about the mobile terminal transmitting the pilot signal. Each of the pilot patterns are spreading code type information, as they are frequency and time division schemes.

113. The '071 patent describes TDMA and FDMA, as well as the CDMA, as the spreading technology. *See, e.g.*, Ex. 1001, 4:52-56. Thus, as Jin discloses the use of OFDMA and using different types of pilot patterns, it discloses each transmitting node transmits spreading code type information on the unshared parameter channel. Ex. 1004, ¶72.

**13. Claim 16: The method of claim 1, wherein the parameter channels are low in communication rate compared to the shared communication channel.**

114. In my opinion, Jin discloses this claim.

115. 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.



116. Jin discloses the pilot subcarrier subchannel (i.e., “**parameter channels**”) as part of basic allocation unit. See, Ex. 1004, FIG. 6. In the basic

allocation unit, there are 12 time and frequency positions, of which 8 are reserved for data. As such the parameter channels are low in communication rate compared to the data channel, i.e., the claimed “shared communication channel.” Accordingly, a POSITA would understand 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.

#### 14. Claim 21

117. In my opinion, Jin discloses claim 21.

118. 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.

| <b>Claim Limitation</b>                                                                                                                                                                                                       | <b>Corresponding Claim Limitation(s)</b>                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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: | 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: |
| 21a: receiving a plurality of parameter-estimating signals each on an unshared                                                                                                                                                | 1b: requiring each transmitting node to transmit a parameter-estimating                                                                                                                                                        |

| Claim Limitation                                                                                                                                      | Corresponding Claim Limitation(s)                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| parameter channel from a corresponding transmitting node;                                                                                             | signal on an unshared said parameter channel;                                                                                                                                           |
| 21b: estimating at least one unique signal parameter for each of the received plurality of parameter-estimating signals; and                          | 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 |
| 21c: distinguishing information concurrently received from the transmitting nodes according to their corresponding estimated unique signal parameter. | 1d: detecting and distinguishing the information simultaneously received from each of the transmitting nodes according to their respective said unique estimated signal parameters.     |

**B. Ground 2: Claims 6-7 are rendered obvious over Jin and Tsai under Section 103**

119. I provide a summary of this ground as follows.

120. While it is my opinion that claims 6 and 7 are obvious over Jin alone, to the extent claims 6 and 7 are not obvious over Jin alone, these claims are 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. Ex. 1006, 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.

121. 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. 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**

122. In my opinion, a POSITA would have been motivated to incorporate Tsai's teaching of a signal amplitude or phase into Jin's signal parameter. It is my opinion that 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. The differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. 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. Ex. 1014, Abstract. A POSITA would understand that a known amplitude and phase timing is used 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. Jin discloses the use of different signal parameters to identify the user for the data transmission, including amplitude and phase. Ex. 1004, ¶77. Tsai provides the teaching of using the amplitude and phase as the signal parameter to identify a user.

123. Tsai teaches “MIMO channel estimation consists of estimating the channel gain and phase information” to differentiate signals from different devices. Ex. 1006, ¶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. Ex. 1006, ¶51. 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, in order to estimate the channel gain and phase information, the receiver must know the amplitude and phase timing of the transmitted signal. 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).

124. Jin teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a MIMO system. Ex. 1004, ¶¶73-76, ¶89. Like Jin, Tsai discloses a MIMO system where multiple signals are simultaneously

transmitted and the amplitude and phase are used to differentiate the signals. Ex. 1006, ¶52 (“MIMO channel estimation consists of estimating the channel gain and phase information for links”).

125. A POSITA would have been motivated to incorporate Tsai’s signal amplitudes and phases for signal identification into Jin, to the extent they are not already incorporated into Jin’s MIMO system. In my opinion, 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. A POSITA would have known that the differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. 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. Ex. 1014, Abstract. A POSITA would understand that a known amplitude and phase timing is used 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. 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. A POSITA would understand that these known differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. Similarly, a POSITA would understand that the use of these known parameters is beneficial, because the signals inherently have these parameters and using these parameters is simple and effective.

126. Given the numerous well-known benefits from using different phase and amplitudes for signals with MIMO and OFDM transmissions, it is my opinion that a POSITA would have been motivated to incorporate Tsai's signal amplitude or phase into Jin's signal parameter to differentiate between signals with different phases and amplitudes. 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 in Tsai would have been a known substitute.

127. A POSITA would have reasonably expected this combination to succeed. In my opinion, 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. In my opinion, estimating the channel conditions from the received phase and amplitude in Jin would have been well within the capabilities of a POSITA. Jin already discloses that the signals have known amplitude and phase parameters (Ex. 1004, ¶77) and the use of these known parameters to identify the user was well known in the art as a design choice.

128. 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. Ex. 1001, Abstract; Ex. 1004, Abstract; Ex. 1006, Abstract.

### 15. Claim 6

129. It is my opinion that Jin in view of Tsai renders obvious claim 6. Claim 6 recites that the unique signal parameter is a signal amplitude. Tsai discloses that “MIMO channel estimation consists of *estimating the channel gain* and phase information for links.” Ex. 1006, ¶52. The channel gain in Tsai determines the **signal amplitude** of the received signal and Tsai discloses using this amplitude to provide signal and channel estimates. *Id.* A POSITA would understand that in the

Jin-Tsai combination, Jin would likewise transmit information and signals that are differentiated by different phase and amplitudes.

**16. Claim 7**

130. It is my opinion that Jin in view of Tsai renders obvious claim 7, which recites that the unique signal parameter is a signal phase. Tsai discloses “MIMO channel estimation consists of *estimating the channel* gain and *phase information for links.*” Ex. 1006, ¶52. The phase information in Tsai is used to determine the **signal phase** of the received signal and Tsai discloses using this phase to provide signal and channel estimates. *Id.* A POSITA would understand that in the Jin-Tsai combination, Jin would likewise transmit information and signals that are differentiated by different phase and amplitudes.

**C. Ground 3: Claims 8-9 are obvious over Jin and Vrzic under Section 103**

131. I provide a summary of this ground as follows.

132. Vrzic is an Apple patent application publication directed to wireless networks that promote simultaneous transmissions between multiple mobile stations. Ex. 1007, Abstract. Vrzic contains several teachings that in my opinion 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.

133. Using a signal's carrier frequency offset and time delay to differentiate the signals in a wireless network was well known, and in my opinion a POSITA would have known these signal parameters inherently identify different signals in a shared communication channel. 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.

#### **17. Motivation to Combine**

134. In my opinion, a POSITA would have been motivated to incorporate Vrzic's teaching of a signal carrier frequency offset and signal relative time delay into Jin's signal parameter. 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. Ex. 1004, ¶77. Vrzic provides these teachings.

##### **(a) Vrzic's Frequency Offset**

135. Using signal carrier frequency offset is a well-known, decades-old type of signal differentiation and in my opinion a POSITA would have known such signal carrier frequency offset allowed for more efficient signal differentiation. Signal carrier frequency offset refers to subcarrier frequencies being differing from the values that were designed for. Such difference can happen due to, for example,

oscillator error, temperature drift. Vrzic discloses 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. Ex. 1007, ¶41. In my opinion, a POSITA would have known that the technique for estimating the signal carrier frequency offset as taught by Vrzic could be incorporated into Jin to aid the process of separating multiple signals.

136. Jin teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a MIMO system. Ex. 1004, ¶¶73-76. In my opinion, a POSITA would have been motivated to incorporate Vrzic’s signal carrier frequency offset into Jin’s signal parameter because of the well-known benefits of using such an offset for signal differentiation. For example, a POSITA would have known that using offsets in carrier frequency is a simple and effective way to differentiate multiple signals in a shared communication channel. Additionally, as Vrzic explains, using carrier frequency offsets allows for “properly process[ing] OFDM symbols” like those taught in Jin. Ex. 1007, ¶41, 44.

137. Given the numerous well-known benefits from using different signal carrier frequency offset for signals with MIMO and OFDM transmissions, my

opinion is that a POSITA would have been motivated to incorporate Vrzić's signal carrier frequency offset into Jin's signal parameter.

138. A POSITA would have reasonably expected this combination to succeed. 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 Vrzić. 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. In my opinion, a POSITA would therefore understand Jin was compatible and readily applicable for using different signal carrier frequency offset for signals.

**(b) Vrzić's Time Delay**

139. Using signal time delays is a well-known, decades-old type of signal differentiation and a POSITA would have known such signal time delays allow for more efficient signal differentiation. A POSITA would further understand that in a system with multiple signals, a system can use the time delay in the signals to identify the node that sent it. POSITAs would also understand that time delays are efficient because they take the known time parameter and can compare the time values to determine delays. 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. Ex. 1014, 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. A POSITA would have known that using a time delay was known as a simple and effective way to differentiate signals in a network, and Vrzić 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.

140. Jin teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a MIMO system. Ex. 1004, ¶¶73-76. In my opinion a POSITA would have been motivated to incorporate Vrzić’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. Time delays are a known parameter that already existed in networks and, as Vrzić 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. Ex. 1007, ¶41, 44. 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. 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.” Ex. 1014, 1:25-32. 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.

141. Given the numerous well-known benefits from using different signal relative time delay for signals with MIMO and OFDM transmissions, in my opinion a POSITA would have been motivated to incorporate Vrzic’s signal relative time delay differentiations into Jin’s signal parameter. 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. Ex. 1004, ¶89 (identifying MIMO); Ex. 1007, ¶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.

142. A POSITA would have reasonably expected this combination to succeed. 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. Accordingly, in my opinion a POSITA would understand Jin was compatible and readily applicable for using different signal relative time delay for signals.

**(c) Analogous Art**

143. 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. Ex. 1001, Abstract; Ex. 1004, Abstract; Ex. 1007, Abstract.

**18. Claim 8**

144. It is my opinion that Jin in view of Vrzic render obvious claim 8, which recites that the unique signal parameter is a signal carrier frequency offset. 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.” Ex. 1007, ¶41. Vrzić’s frequency offset logic uses signal carrier frequency offset to differentiate signals, as Vrzić discloses that it uses this parameter to provide estimates and “properly process OFDM signals” and the offset must be estimated first to correct any offset. *Id.* In my opinion, in the Jin-Vrzić combination, a POSITA would understand that Jin would likewise transmit information and signals that are differentiated by different signal carrier frequency offset.

## 19. Claim 9

145. It is my opinion that Jin in view of Vrzić render obvious claim 9, which recites that the unique signal parameter is a signal relative time delay. Vrzić 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.” Ex. 1007, ¶41. Vrzić’s clock estimation logic uses time delay offset to differentiate signals, as Vrzić discloses that it uses this parameter to provide estimates and “properly process OFDM signals.” *Id.* This disclosure in Vrzić 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.” Ex. 1014, 1:25-32. In my opinion, in the Jin-Vrzic combination, a POSITA would understand that Jin would likewise transmit information and signals that are differentiated by different signal carrier frequency offset.

**D. Ground 4: Claims 1-11, 16, 21 Are Rendered Obvious by Baum under Section 103**

146. I provide a summary of this ground as follows.

147. Baum discloses reducing the impact of interference in OFDM wireless communication systems by implementing a detector in a “receiver” that uses “joint detection.” Ex. 1005, 5:17-47, 18:1-8. Baum uses synchronization signals for estimating various parameters 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 a received signal containing known data such as the broadcast synchronization signal.” Ex. 1005, 9:27-33, 19:3-59.

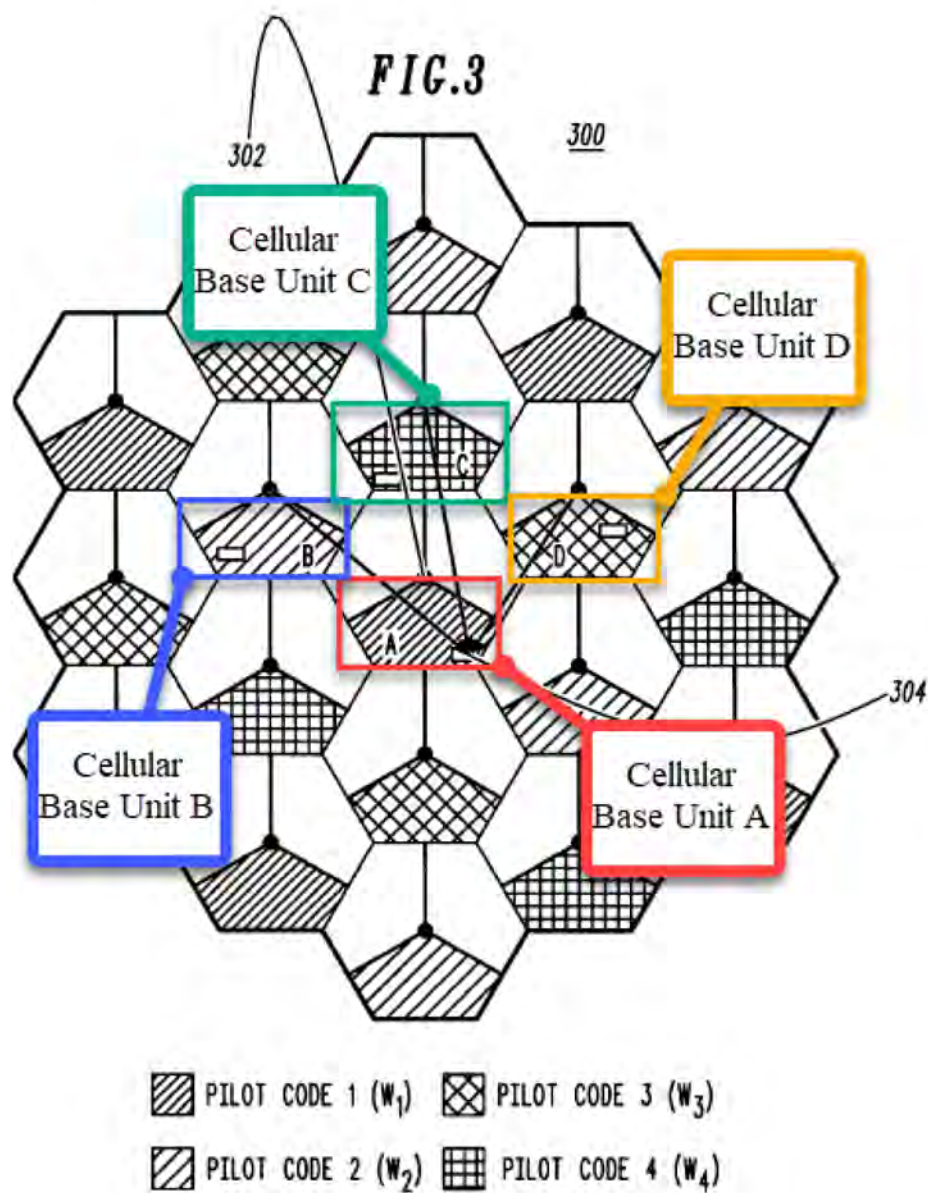
**20. 1pre**

148. In my opinion, Baum discloses this claim limitation to the extent the preamble is limiting.

149. Baum discloses the claim element “***a method for enabling a receiving node to distinguish information simultaneously received***” as it discloses the receiving node is a subscriber unit (subscriber 304 in sector A), which receives “simultaneously” from the four base units. *Id.*, 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. Ex. 1005, 18:1-15. A POSITA would understand that 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. *Id.* 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”. Ex. 1005, 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. Ex. 1005, 5:17-47, 18:1-8.

150. Baum discloses the claim element “***from a plurality of transmitting nodes***” as 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”).



151. Baum discloses the claim element “*transmitting ... on a shared communication channel*” as 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. *Id.*, 6:21-23. 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. Ex. 1013, 25.

152. Accordingly, it is my opinion that Baum discloses the claim element “*of a wireless digital network*” as Baum’s cellular network uses digital modulation (“**wireless digital network**”), such as a QAM or QPSK. Ex. 1005, 4:16-27, 13:49-54.

(a) 1a

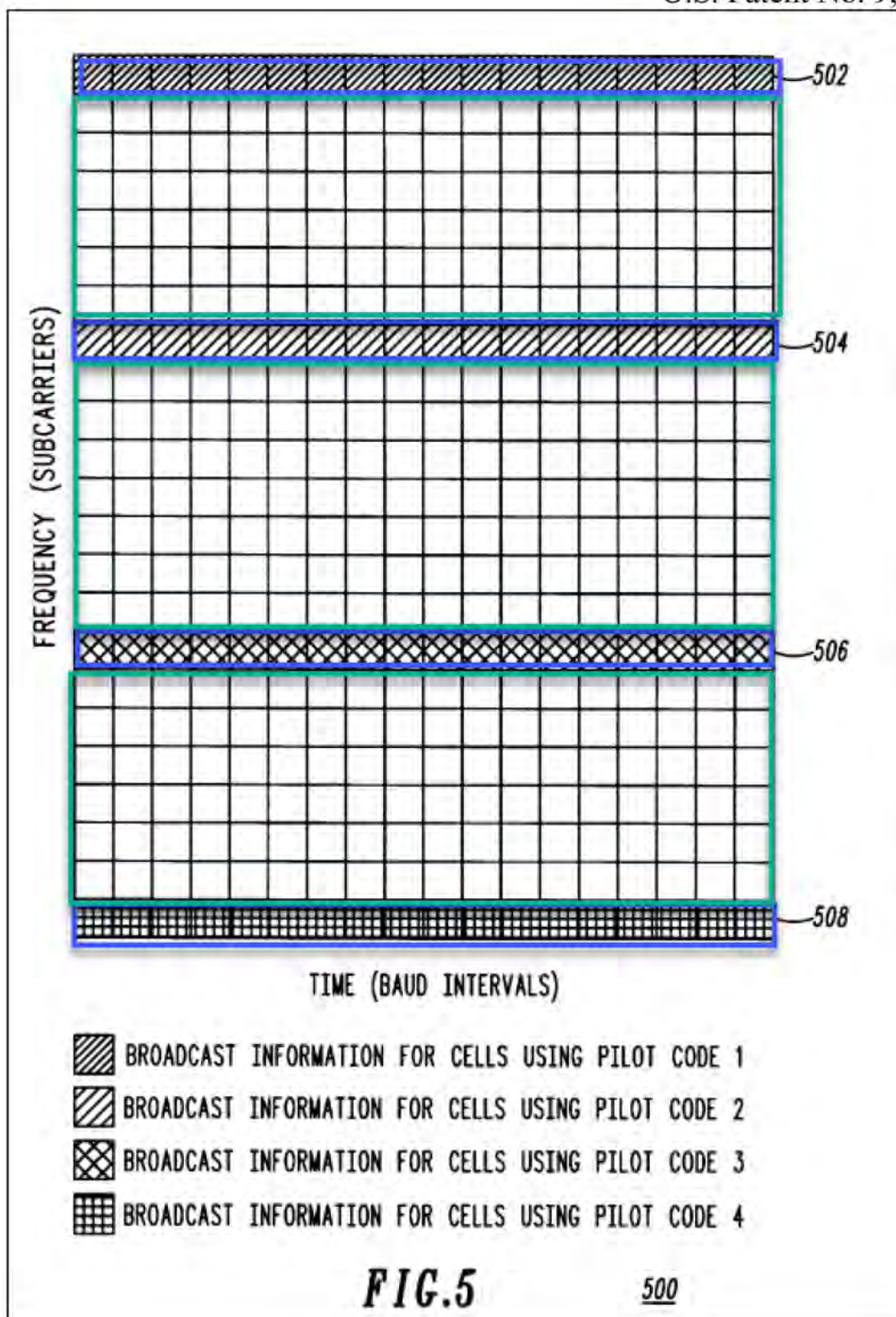
153. In my opinion, Baum discloses this claim limitation.

154. 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. Ex. 1005, 9:14-33, 19:3-29. 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.* A POSITA would understand that 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. Ex. 1005, 8:53-57, 24:19-50. 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. Ex. 1013, 25.

155. 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. 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. Ex. 1005, 19:3-59

156. In Fig. 5 (below), 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". Accordingly, it is my opinion that Baum discloses the claim limitation.



(b) 1b

157. In my opinion, Baum discloses this claim limitation.

158. Baum discloses the claim element “*parameter estimating signal*” as Baum discloses a synchronization signal as the claimed parameter-estimating signal. 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.” Ex. 1005, 9:27-33. A POSITA would understand that the synchronization signals in Baum are the “parameter-estimating signal” because they are used to estimate relative propagation delays and adjacent-subcarriers phase differences. Ex. 1005, 9:27-36.

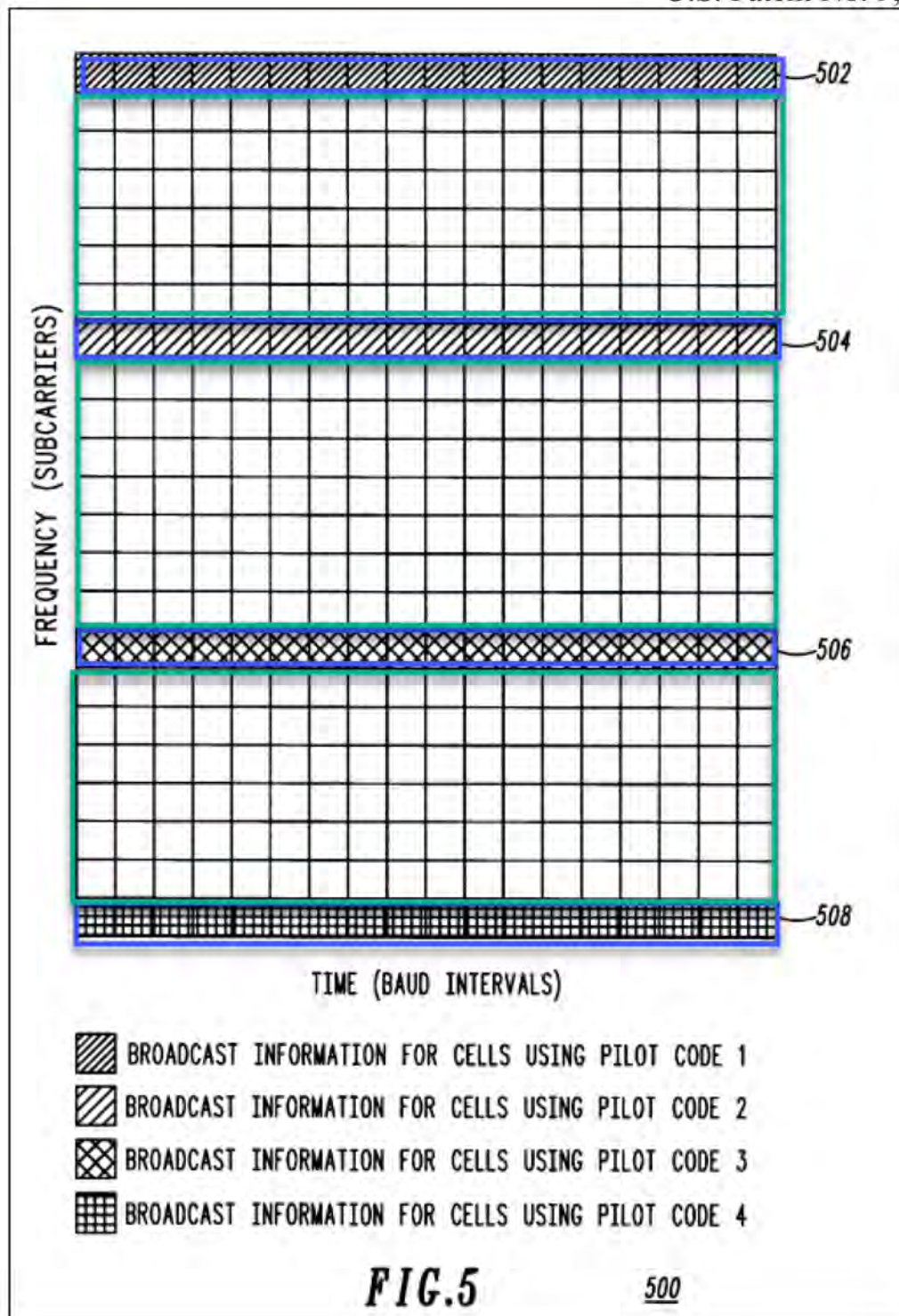
159. In my opinion Baum discloses the claim element “*each transmitting node transmits a parameter-estimating signal on an unshared said parameter channel*” because Baum discloses that synchronization signals from two different base stations are “non-interfering” as they are transmitted using different “time/frequency” resources. Ex. 1005, 10:5-11, 24:39-50. 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.” *Id.*, 24:39-50. In my opinion, a POSITA would understand that Baum’s different, non-interfering, time and/or frequency regions for transmitting synchronization signals (“parameter-estimating signal”) are the claimed “unshared said parameter channel.” Accordingly, it is my opinion that Baum discloses this claim limitation.

(c) 1c

160. In my opinion, Baum discloses this claim limitation.

161. Baum discloses the claim element “*detecting the parameter-estimating signals on the unshared parameter channels*” as 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**”). Ex. 1005, 9:24-36. This is shown in Fig. 5 below, where the unshared parameter channels have different time and frequency regions:



162. Baum discloses the claim element “*estimating ... at least one unique signal parameter for each of the transmitting nodes*” as Baum it 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**”). Ex. 1005, 9:24-36, 19:3-20:56. 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.* In my opinion, a POSITA would understand that 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.* Accordingly, it is my opinion that Baum discloses this claim limitation.

(d) 1d

163. In my opinion, Baum discloses this claim limitation. 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**”). Ex. 1005, 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,” which a POSITA would understand to be the claimed “**information simultaneously received**”. *Id.*, 18:1-15. Baum discloses the subcarrier phase difference is “accounted for in the detection algorithms in the receiver.” *Id.*, 9:11-36. A POSITA would understand that 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. 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.” Ex. 1005, 21:3-21. Thus, Baum discloses “**detecting and distinguishing**” the received information.

164. 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.” Ex. 1005, 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. A POSITA would have known Baum discloses using joint detection in every embodiment because 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. Ex. 1005, 5:17-47, 18:1-8. Accordingly, it is my opinion that Baum discloses this claim limitation.

## **21. Claim 2**

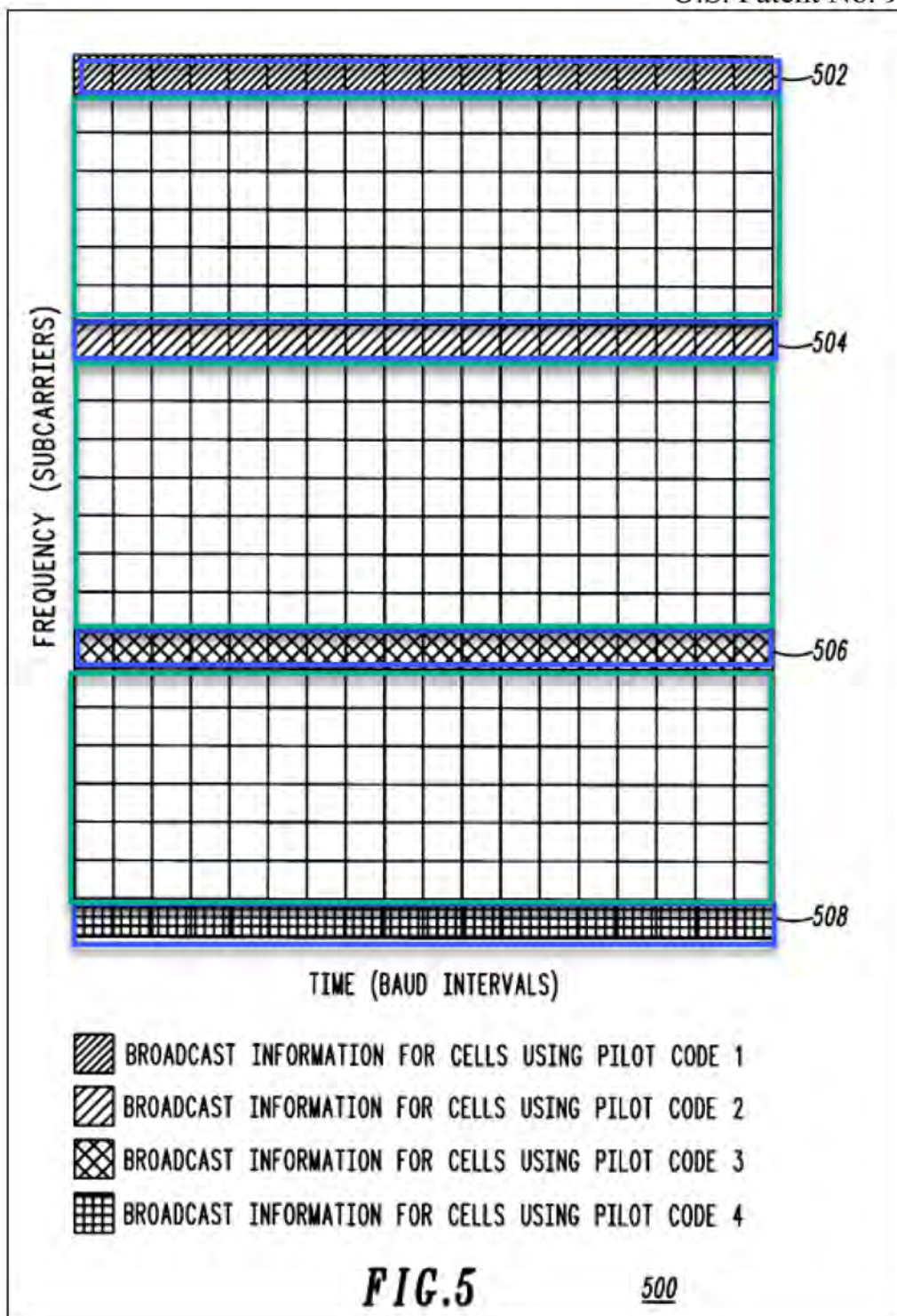
165. In my opinion, Baum discloses this claim. Baum discloses using channel-spreading technology, like time division and frequency division (*i.e.*, “**channel-spreading technology**”), to provide a plurality of parameter channels. Ex. 1005, 8:53-57, 9:2-13, 19:50-62. Baum’s disclosure of time division and frequency division is consistent with the ’071 patent’s characterization of “time division” and “frequency division” as channel-spreading technology. Ex. 1001, 2:42-60.

## **22. Claim 3**

166. In my opinion, Baum discloses this claim. Baum discloses using time division (“**TDMA**”) and frequency division (“**FDMA**”) to provide a plurality of parameter channels. Ex. 1005, 8:53-57, 19:50-62.

**23. Claim 4**

167. In my opinion, Baum discloses this claim. 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**”). Ex. 1005, 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:



168. 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. A POSITA would understand that 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**”). Ex. 1005, 3:32-34, 7:48-58, 14:54-61. Accordingly, it is my opinion that Baum discloses this claim limitation.

#### 24. Claim 5

169. In my opinion, Baum discloses this claim. A POSITA would understand that 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**”). Ex. 1005, 9:14-17. 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. Ex. 1005, 8:53-57, 19:50-62. Thus, a POSITA would understand that the synchronization signals in Baum are a symbol pattern. Accordingly, it is my opinion that Baum discloses this claim.

**25. Claim 6**

170. In my opinion, Baum discloses this claim. A POSITA would understand that Baum discloses the use of different signal parameters to identify the base station for the data transmission, including amplitude. Ex. 1005, 4:65-5:10, 20:60-63. Baum discloses that the base station uses channel gain value (*i.e.*, “**signal amplitude**”) as a unique parameter (*i.e.*, “**unique signal parameter**”). *Id.* Accordingly, it is my opinion that Baum discloses this claim limitation.

**26. Claim 7**

171. In my opinion, Baum discloses this claim. A POSITA would understand that Baum discloses the use of different signal parameters to identify the base station for the data transmission, including phase (*i.e.*, “**signal phase**”). Ex. 1005, 20:24-41, 20:64-21:2. Baum discloses that the base station uses the phase difference between signals as a unique signal parameter (*i.e.*, “**unique signal parameter**”). *Id.* Accordingly, it is my opinion that Baum discloses this claim.

**27. Claim 8**

172. In my opinion, Baum discloses this claim. 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**”). Ex. 1005, 9:11-17, 14:46-50. A POSITA would know that “[f]requency

synchronization” in OFDM includes frequency offset estimation (*i.e.*, “**signal carrier frequency offset**”). An earlier patent assigned to Collision (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. Ex. 1014, Abstract. A POSITA would also understand that frequency synchronization is used to derive 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. Accordingly, it is my opinion that Baum discloses this claim.

## 28. Claim 9

173. In my opinion, Baum discloses this claim. 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 co-channel 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*.” Ex. 1005, 9:24-36. A POSITA would understand that 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**”). 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. Ex. 1014, 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. Accordingly, it is my opinion that Baum discloses this claim.

## 29. Claim 10

174. In my opinion, Baum discloses this claim. 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**”). Baum discloses the scheme of transmitting synchronization signals is used to transmit “**identification signals**.” Ex. 1005, 14:24-33, 24:39-50. Baum discloses “**transmit[ting]** at least one of: synchronization signals and **identification signals** ... [and] **transmit[ting]** 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.” Ex. 1005, 24:39-50. Additionally, Baum discloses that synchronization signals from different base units are monitored to determine

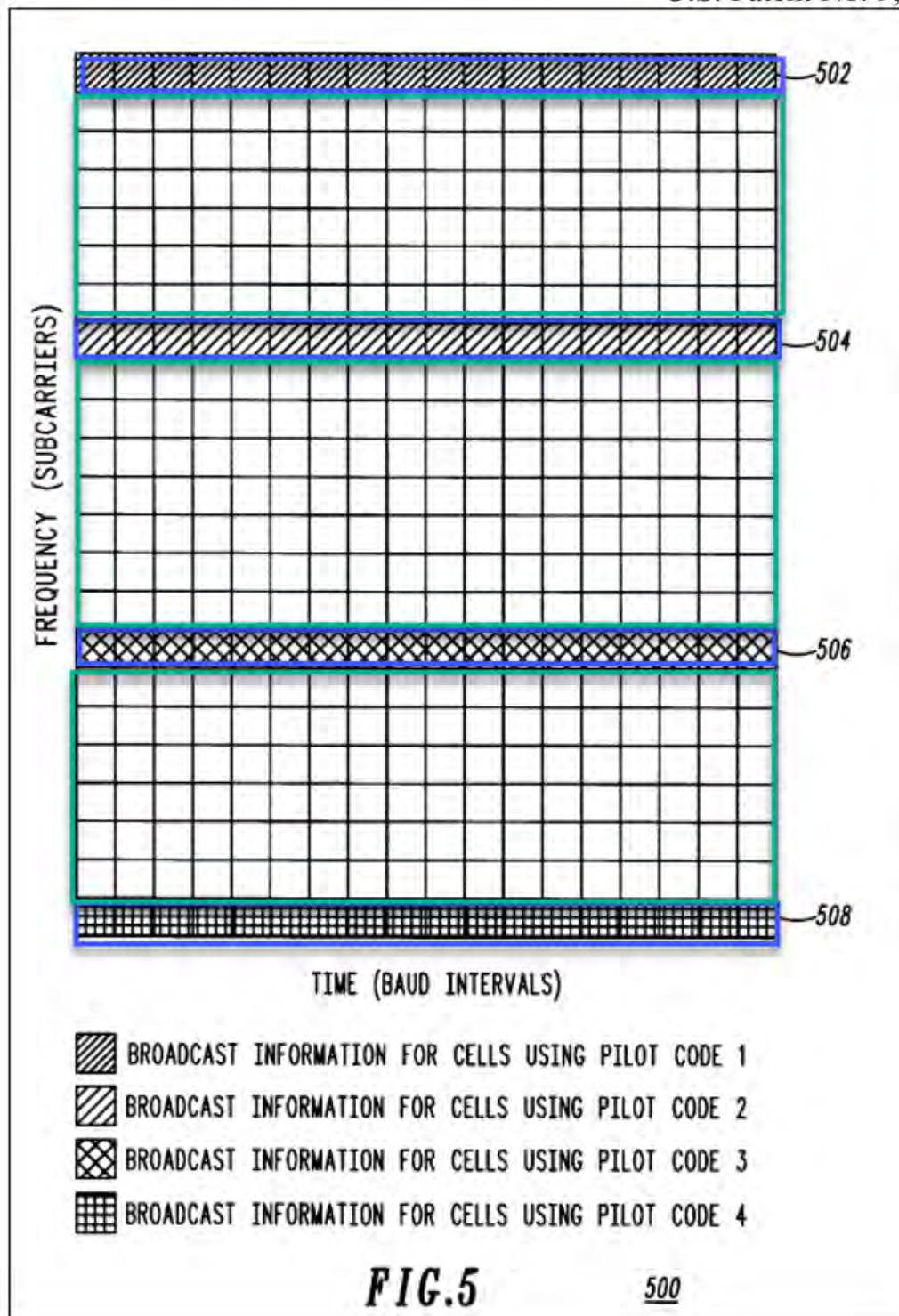
which provides the “best signal quality” to identify a serving base unit. Ex. 1005, 14:24-33. A POSITA would understand that the different synchronization signals are unique to their associated base units, which means the synchronization signals identify different base units. Accordingly, it is my opinion that Baum discloses this claim.

### 30. Claim 11

175. In my opinion, Baum discloses this claim. 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. Ex. 1005, 9:11-17, 14:46-50. A POSITA would understand that each of the synchronization code patterns are spreading code type information, as they are frequency and time division schemes. The ’071 patent describes TDMA and FDMA, as well as the CDMA, as the spreading technology. *See, e.g.*, Ex. 1001, 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. Ex. 1005, 8:53-57, 19:50-62. Accordingly, it is my opinion that Baum discloses this claim.

**31. Claim 16**

176. In my opinion, Baum discloses this claim. 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. Ex. 1005, 13:38-48. As shown in Fig. 5, Baum discloses the “parameter channel” has fewer slots than the “shared communication channel”:



177. A POSITA would understand 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. Accordingly, it is my opinion that Baum discloses this claim.

### **32. Claim 21**

178. In my opinion, Baum discloses this claim. 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.

| <b>Claim Limitation</b> | <b>Corresponding Claim Limitation(s)</b> |
|-------------------------|------------------------------------------|
| 21pre                   | 1pre                                     |
| 21a                     | 1b                                       |
| 21b                     | 1c                                       |
| 21c                     | 1d                                       |

### **B. Ground 5: Claims 6-7 are obvious over Baum and Tsai**

179. To the extent claims 6 and 7 are not obvious over Baum alone—they are, as I explained in Ground 4, *supra*—these claims are obvious over the combination of Baum and Tsai. Tsai is a Samsung patent application publication directed to wireless networks that promote simultaneous transmissions between

multiple mobile stations. Ex. 1006, Abstract, ¶8. Tsai contains several teachings that in my opinion would have been obvious for a POSITA to incorporate into Baum: the use of signal amplitude and the use of signal phase as signal parameters.

180. 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 to a POSITA, as set forth in claims 6 and 7. 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 Baum to include Tsai's teachings.

#### **1. Motivation to Combine**

181. A POSITA would have been motivated to incorporate Tsai's teaching of a signal amplitude or phase into Baum's signal parameter. 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. A POSITA would understand that the differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. 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. Ex. 1014, Abstract.

A POSITA would understand that a known amplitude and phase timing is used 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. Baum discloses the use of different signal parameters to identify the user for the data transmission, including gain and phase. Ex. 1005, 9:7-36.

182. Tsai teaches “MIMO channel estimation consists of estimating the channel gain and phase information” to differentiate signals from different devices. Ex. 1006, ¶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. Ex. 1006, ¶51. In performing this process, a POSITA would understand that the signal amplitude and phase must be known and used in performing the signal identification. *Id.* A POSITA would further understand that, in order to estimate the channel gain and phase information, the receiver must know the amplitude and phase timing of the transmitted signal. 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).

183. Baum teaches simultaneously transmitting multiple signals over a channel and needing to differentiate the signals in a OFDM system. Ex. 1005, 3:32-

34, 7:48-58, 14:54-61. Like Baum, Tsai discloses an OFDM system with signal amplitudes and phases. Ex. 1006, ¶52 (“MIMO channel estimation consists of estimating the channel gain and phase information for links”).

184. 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. 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. A POSITA would understand these known differences between the transmitted amplitude and phase timing and those of the received are used to estimate the channel. A POSITA would further understand the use of these known parameters is beneficial, because the signals inherently have these parameters and using these parameters is simple and effective. 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. 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.

185. A POSITA would have reasonably expected this combination to succeed. 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. In my opinion, estimating the channel conditions from the received phase and amplitude in Jin would have been well within the capabilities of a POSITA. Baum already discloses that the signals have known amplitude and phase parameters (Ex. 1005, 9:7-36) and the use of these known parameters to identify the user was well known in the art as a design choice.

186. 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. Ex. 1001, Abstract; Ex. 1005, Abstract; Ex. 1006, Abstract.

**2. Claim 6**

187. In my opinion, Baum in view of Tsai renders obvious claim 6, which recites that the unique signal parameter is a signal amplitude. Tsai states with MIMO and OFDM, “*MIMO channel estimation* consists of *estimating the channel gain* and phase information for links.” Ex. 1006, ¶52. The channel gain in Tsai determines the **signal amplitude** of the received signal and Tsai discloses using the amplitude to provide signal and channel estimates. *Id.* In the Baum-Tsai combination, a POSITA would understand Baum would likewise transmit information and signals that are differentiated by different amplitudes.

**3. Claim 7**

188. In my opinion, Baum in view of Tsai renders obvious claim 7, which recites that the unique signal parameter is a phase. Tsai states with MIMO and OFDM, “*MIMO channel estimation* consists of estimating the channel gain and *phase information for links.*” Ex. 1006, ¶52. The phase information in Tsai is used to determine the **signal phase** of the received signal and Tsai discloses using this phase to provide signal and channel estimates. *Id.* In the Baum-Tsai combination, a POSITA would understand Baum would likewise transmit information and signals that are differentiated by different phase.

**VIII. Secondary Considerations of Non-obviousness**

189. I am not aware of any secondary considerations, or so-called “objective

indicia of non-obviousness” for the challenged claims.

190. Secondary considerations could include things like commercial success of a product due to the merits of the claimed invention; a long felt need for the solution provided by the claimed invention; unsuccessful attempts by others to find the solution provided by the claimed invention; copying of the claimed invention by others; unexpected and superior results from the claimed invention; acceptance by others of the claimed invention as shown by praise from others in the field or from the licensing of the claimed invention; teaching away from the conventional wisdom in the art at the time of the invention; independent invention of the claimed invention by others before or at about the same time as the named inventor thought of it; and other evidence tending to show obviousness.

191. Patent Owner has not identified any such secondary considerations, and I am not independently aware of any. For example, Patent Owner has no commercial products embodying the '071 patent that I am aware of. Additionally, as discussed throughout, the claimed features reflect predictable results of combining known elements according to their known functions, and thus, there are no unexpected and superior results from the claimed invention. Also, there are no licenses of the '071 patent of which I am aware.

192. Further, even if Patent Owner were to assert that secondary

considerations exist, given the strong reasons that the challenged claims are obvious in light, including the motivations to combine the references set forth above, I do not believe any such secondary considerations would rise to the level of overcoming the invalidity opinions I have expressed.

193. I understand that Patent Owner may address the issue of secondary considerations more fully in the future. I reserve the right to respond to any specific bases for such secondary considerations that Patent Owner may identify.

## **IX. Conclusion**

194. For the reasons set forth above, I believe claims 1-11, 16, 21 of the '071 patent are unpatentable in view of the prior art. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

195. I declare that all statements made herein of my knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like

Declaration of Paul S. Min Ph.D.

*Inter Partes* Review

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

so made are punishable by fine or imprisonment, or both, under Section 1001 of Title  
18 of the United States Code.

Dated: August 2, 2024

By:   
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Paul S. Min, Ph.D.