

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re *Inter Partes* Review of:)
U.S. Patent No. 10,447,450)
Issued: Oct. 15, 2019)
Application No.: 15/676,421)
Filing Date: Aug. 14, 2017)

For: **Method And System For Multi-Carrier Packet Communication With
Reduced Overhead**

**DECLARATION OF TODOR COOKLEV IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,447,450**

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I, Todor Cooklev, declare as follows:

I. Introduction

1. I have been retained by Latham & Watkins on behalf of Ford Motor Company (“Ford” and/or “Petitioner”) for the above-captioned *inter partes* review proceeding. I understand that this proceeding involves U.S. Patent No. 10,447,450 (“’450 patent”), which is entitled “Method and System for Multi-Carrier Packet Communication with Reduced Overhead,” and that the ’450 patent is currently assigned to Neo Wireless LLC (“Patent Owner”).

2. Specifically, I have been retained as a technical expert by Ford to study and provide my opinions on the technology claimed in, and the patentability or unpatentability of, claims 7 and 11 of the ’450 patent. This declaration is directed to claims 7 and 11 of the ’450 patent, and sets forth the opinions I have formed, the conclusions I have reached, and the bases for each. For purposes of this declaration, I was not asked to provide any opinions that are not expressed herein.

3. I am familiar with the technology described in the ’450 patent as of its earliest possible priority date of September 28, 2005. I have been asked to provide my technical review, analysis, insights, and opinions regarding the ’450 patent. I have used my experience and insight along with the references identified herein as the basis for my opinions that support the grounds of unpatentability set forth in the Petition for *Inter Partes* Review of the ’450 patent.

4. I have reviewed and am familiar with the specification of the '450 patent issued on October 15, 2019. I understand that the '450 patent has been provided as Exhibit 1001.

5. I am more than eighteen years of age, and I am a citizen of the United States, currently residing in the state of Indiana.

6. I am being compensated by Ford at my standard hourly rate of \$700 for the time I spend in connection with this proceeding. My compensation is not dependent in any way on the substance of my opinions or in the outcome of this proceeding.

II. Grounds of Unpatentability

7. In forming my opinions about the '450 patent, I have considered the following grounds of unpatentability. Based on my review of the prior art references that form the basis of these grounds, it is my opinion that claims 7 and 11 of the '450 patent would have been obvious to a person of ordinary skill in the art ("POSA") as of September 28, 2005.

Ground	Basis	Claims	References
1	§ 103	7, 11	Park + 802.16-2004

III. Qualifications

8. In formulating my opinions, I have relied upon my knowledge, training, and experience in the relevant art. My qualifications are stated more fully

in my *curriculum vitae*, which has been provided as Exhibit 1004. My *curriculum vitae* also lists the depositions, hearings, and trials at which I have testified. Here, I provide a brief summary of my qualifications.

9. I am currently Professor of Electrical and Computer Engineering at Purdue University in Fort Wayne, Indiana, where I have had several administrative positions.

10. My current research interests include most aspects of modern wireless systems, including hardware and software architectures. A significant part of my research is specifically focused on standards-related issues. I have received a number of research grants in these areas. My research has been funded by DARPA, the Air Force Research Laboratory, the Office of Naval Research, and other organizations. My teaching responsibilities have included courses in communication systems and networks, signals and systems, software-defined radio, and digital signal processing.

11. I am a named inventor on more than thirty U.S. patents, most of which relate to the hardware or software aspects of communication systems. In 2019, I was inducted into the Purdue Inventors Hall of Fame. I have also authored and co-authored more than one hundred peer-reviewed articles. I also authored “Wireless Communication Standards: A Study of IEEE 802.11, 802.15, and 802.16,” published by IEEE Press.

12. I graduated from the Technical University of Sofia, Bulgaria in 1988 with a Diploma of Engineering in the field of Electrical Engineering. I graduated from Tokyo Institute of Technology in Tokyo, Japan in 1995 with a Doctor of Philosophy (Ph.D.) degree in Electrical Engineering.

13. I have contributed to the development of several major standards for communication systems and numerous amendments, including IEEE 802.16. Since 2000, I have reviewed and voted on most IEEE 802.16 standards. I have participated in many meetings of standards committees and prepared, submitted, and presented documents relating to technical matters considered by these committees. I have also drafted liaison letters between the 802.11 and 802.16 standards committees. I have chaired some committee meetings and served in other leadership roles. For example, I chaired a Study Group within IEEE 802.11 and served as Chairman of the IEEE Standards in Education Committee. I also received an award from IEEE Standards Association in 2012.

14. My additional involvement with IEEE includes being elected to serve on the Board of Governors of the IEEE Standards Association in 2020 for one term beginning January 2021. The Board of Governors provides overall leadership of the IEEE Standards Association. Also, I am the Series Editor for Wireless and Radio Communications for the IEEE Communications Standards Magazine (which

is the premier journal in the field of communication standards) and have held that position since 2017.

IV. Materials Considered

15. In formulating my opinions, I have relied upon my training, knowledge, and experience relevant to the '450 patent, including drawing on my experience in the field of wireless communications. Furthermore, I have considered specifically the following documents listed below in addition to any other documents cited in this declaration:

Ex.	Description
1001	U.S. Patent No. 10,447,450 (“’450 Patent”)
1004	<i>Curriculum Vitae</i> of Dr. Todor Cooklev
1005	U.S. Patent Application Publication No. 2006/0039274 A1 (“Park”)
1006	IEEE, <i>IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems</i> , IEEE STANDARDS 802.16 (Oct. 2004) (“802.16-2004”)
1007	Declaration of David Ringle (Mar. 1, 2023) (“Ringle Decl. (802.16-2004)”)
1008	Certified Translation of Korean Patent Application No. 65099/2004 (“Park Translation”)
1014	IEEE, <i>IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems – Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands and Corrigendum 1</i> , IEEE STANDARDS 802.16e (Dec. 2005) (“802.16e-2005”)

Declaration for *Inter Partes* Review of USP 10,447,450

Ex.	Description
1015	Declaration of David Ringle (Mar. 16, 2023) (“Ringle Decl. (802.16e-2005)”)
1016	IEEE, <i>IEEE 802.16 Published Standards and Drafts</i> , https://www.ieee802.org/16/published.html (last visited Mar. 14, 2023, 2:43 PM)
1017	IEEE, <i>IEEE Standard 802.16-2004: Publication History (Updated 2004-04-04)</i> , https://www.ieee802.org/16/pubs/80216-2004.html (last visited Mar. 15, 2023, 8:34 AM)
1022	Roger Marks, Presentation: <i>IEEE 802.16 WirelessMAN® Standard: Myths and Facts</i> , 2006 Wireless Communications Conference, Wash., D.C. (Doc. No. IEEE C802.16-06/007r1) (June 29, 2006) (“Marks”)
1023	Soon Young Yoon, Presentation: <i>Introduction to WiBro Technology</i> , Telecom R&D Center, Samsung Electronics Co., Ltd. (Sept. 10, 2004) (“Yoon”)
1024	Kim Tong-hyung, <i>Seoul Chooses Standard for Wireless Broadband Access</i> , THE KOREA HERALD (July 29, 2004)
1025	IEEE, <i>IEEE Standards Wireless Networks Series: WirelessMan®, Inside the IEEE 802.16™ Standard for Wireless Metropolitan Networks</i> (2006) (“Eklund”)
1026	<i>Wireless Internet Operators to Be Picked</i> , KOREA TIMES (July 30, 2004)
1027	Sorour Falahati et al., <i>Adaptive Modulation Systems for Predicted Wireless Channels</i> , 52 IEEE TRANSACTIONS COMMC’NS 307 (Feb. 2004) (“Falahati”)

16. My opinions are additionally guided by my appreciation of how a person of ordinary skill in the art would have understood the claims of the ’450

patent at the time of the alleged invention, which I have been asked to assume is September 28, 2005.

V. Legal Understanding

17. I am not an attorney. However, I have been informed by counsel of certain legal standards and have applied those standards, described below, in formulating my opinions.

18. I understand that the claims of a patent define the limits of the patentee's exclusive rights. I understand that to determine the scope of the claimed invention, courts may construe claim terms, the meaning of which the parties may dispute. I understand that claim terms should generally be given their ordinary and customary meaning as understood by a person of ordinary skill in the art at the time of filing of the patent application.

19. I understand that claims must be construed in light of and consistent with the intrinsic evidence. In this context, I understand that intrinsic evidence includes the claims themselves, the written disclosure in the specification, and the patent's prosecution history, including prior art that was considered by the United States Patent and Trademark Office. I understand that the specification is always highly relevant to the claim construction analysis and often is the single best guide to the meaning of a disputed term. I understand that extrinsic evidence may also be considered when construing claims and may include, for example, technical

dictionaries, technical publications and books, treatises, and expert testimony, though the intrinsic record will be more persuasive as to the meaning of a particular term.

20. I understand that a prior art reference can render a patent claim obvious to a POSA if the differences between the subject matter set forth in the patent claim and the prior art are such that the subject matter of the claim would have been obvious at the time the claimed invention was made. In analyzing obviousness, I understand that it is important to consider the scope of the claims, the level of skill of a POSA in the relevant art, the scope and content of the prior art, the differences between the prior art and the claims, and so-called “secondary considerations” of non-obviousness.

21. I understand that obviousness cannot be based on the hindsight combination of components selectively culled from the prior art. I understand that in an obviousness analysis, neither the motivation nor the avowed purpose of the inventors controls the inquiry. Any need or problem known in the field at the time of the invention and addressed by the patent can provide a reason for combining elements. For example, I understand that it is important to consider whether there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent’s claims. I understand that known

techniques can have obvious uses beyond their primary purposes and that in many cases a POSA can fit the teachings of multiple pieces of prior art together.

22. I understand that certain issues relating to validity must be judged from the perspective of a POSA. I further understand that factors that may be considered in determining the level of skill of a POSA include, but are not limited to, (1) the type of problems encountered in the art; (2) prior art solutions to those problems; (3) rapidity with which innovations are made; (4) sophistication of the technology; and (5) the educational level of active workers in the field.

23. I have been informed and understand that a POSA is a hypothetical person who is presumed to be aware of all pertinent prior art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. Importantly, this hypothetical person is of ordinary skill in the art to which the claimed subject matter pertains.

24. I understand that, when there is a reason to solve a problem and there are a finite number of identified, predictable solutions, a POSA has good reason to pursue the known options within his or her technical grasp. I further understand that, if this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense, which bears on whether the claim would have been obvious.

25. I understand that secondary considerations of nonobviousness can include, for example, evidence of commercial success of the invention, evidence of a long-felt need that was solved by an invention, evidence that others copied an invention, or evidence that an invention achieved an unexpected result. I further understand that such evidence must have a nexus, or causal relationship to the elements of a claim, in order to be relevant.

VI. Summary of the '450 Patent

26. The '450 patent is titled "Method and system for multi-carrier packet communication with reduced overhead."

27. The patent relates a method and system "for minimizing the control overhead in a multi-carrier wireless communication network that utilizes a time-frequency resource." '450 patent at Abstract, 1:51-2:16. By "reduced overhead," the '450 patent is referring to a reduction in the number of bits "necessary for mapping a packet stream to a portion of the time-frequency resource." *Id.*

28. To do this, the '450 patent divides the time-frequency resource into "zones" that are "designated for particular applications," such as "voice-over-IP (VoIP) applications." '450 patent at Abstract, 5:43-46, Fig. 6. The '450 patent also divides the zones into segments. '450 patent at 5:54-6:2, 6:22-29. The segments, in turn, are made up of "basic resource units." '450 patent at 7:12-27, 8:27-35.

29. To describe the segment, the patent uses the number of basic resource units as well as an index value. '450 patent at 7:12-27, 8:27-35.

30. As explained in the specification, Figure 6 shows the time-resource divided into Zone 1 through Zone n, labeled in the figure as 605a, 605b, and 605n. '450 patent at 6:3-14, Fig. 6. The same figure also shows segments V_1 through V_m within Zone 1, each segment having an index value in the format VZ_i , where the figure shows indices VZ_1 through VZ_m . '450 patent at 6:3-14, 7:7-12, Fig. 6.

31. The index and the number of basic resource units are related. As Figure 6 again shows, the first packet stream begins at $VZI_1=0$ and has one basic resource unit. '450 patent at 7:18-21. The next stream therefore starts at $VZI_2=1$, which indicates the next available unit. '450 patent at 7:21-24. Since the second packet stream uses eight basic resource units, the third packet stream would start at $VZI_3=9$. '450 patent at 7:24-26. The index effectively counts up the basic resource units.

32. The '450 patent incorporates two more features to reduce overhead, both of which come from the IEEE 802.16 standard.

33. The first of these is an "MCS," which refers to a modulation and coding scheme. '450 patent at 2:2-6. As Table 1 in the '450 patent shows, MCS indicates information such as coding rate. In an 802.16 system, using MCS would take up bits in the overhead. As the '450 patent explains, 802.16 uses a 4-bit MCS.

'450 patent at 2:2-6. The '450 patent conveys the MCS information using another index that it refers to as the modulation and coding scheme index or "MCSI." '450 patent at 6:49-51, 6:55-57, 7:20-24. The '450 patent contemplates using the MCSI to represent the number of basic resource units used by a given packet stream. '450 patent at 6:49-51, 6:55-57, 7:20-24.

34. The second feature is a connection identifier or CID, which is another feature of the 802.16 standard used to identify a mobile station. '450 patent at 1:51-55, 8:23-26. The patent labels different types of CIDs, including ACID, BCID, and VCID. 1:51-55, 8:23-26, 9:23-27, 10:11-15.

35. The '450 patent includes this information (index, number of basic resource units, CID, and MCS) in an IE, a shorthand for a control message known as an Information Element that is also used in the 802.16 standard. '450 patent at 10:1-15. The IE is transmitted by the base station to the mobile station prior to any downlink data transmission in order to provide information to the mobile device so that the mobile device can receive the data transmission properly. '450 patent at 10:17-31.

VII. Level of Skill in the Art

36. A POSA at the time of the earliest claimed priority date, September 28, 2005, would have a bachelor's degree in electrical engineering, computer engineering, computer science, or an equivalent field, or an advanced degree in

those fields, as well as at least 3-5 years of academic or industry experience in mobile wireless communications, or comparable industry experience.

37. At the time of the earliest claimed priority date, and at the time of the alleged invention, I met the qualifications of a POSA. Although my experience and education at that time exceeded that of a POSA, I would have been personally familiar with the knowledge and capabilities of a POSA based on my experiences as a consultant for several different companies and involvement in IEEE working groups throughout my career, including on and around the time of the alleged invention. In particular, I would have been exposed to the knowledge and capabilities of a POSA through my roles as a consultant and working group member, both of which involved interfacing with engineers and scientists with a range of degrees and experiences, including those with a bachelor's or advanced degree in these fields and 3-5 years or more of experience in mobile wireless communications or a similar industry.

38. I have applied the perspective of a POSA in forming and expressing my opinions. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the art at the relevant time.

VIII. Claim Construction

39. Other than the terms discussed in the sections below that counsel asked me to address, I have applied the plain and ordinary meanings of the claim

terms in the '450 patent as a POSA would have understood them in the context of that patent in approximately September 2005. Unless otherwise specified, my analysis does not depend on any particular or precise construction of a term, because I did not find that to be necessary to provide my opinions regarding the relationship between the prior art and the claims of the '450 patent. The opinions that I provide in this declaration would remain true under any reasonable construction of the claim terms in the '450 patent.

40. For the preamble and three additional terms, I have been informed by counsel that the parties have agreed to the below constructions and I was asked to apply them in my analysis.

41. For the *preamble*, I understand that the parties have agreed that it limits the scope of the claims.

42. For “*configured to*,” I understand that the parties have agreed to construe the term as “designed to.”

43. For “*time-frequency coordinate*,” I understand that the parties have agreed to construe the term as “one-dimensional starting time-frequency coordinate.”

44. For “*wherein modular coding is applied*,” I understand that the parties have agreed to construe the term as “wherein a modular coding scheme is applied.”

45. For another term, “*time-frequency resource unit*,” I was instructed to apply the plain and ordinary meaning, and, in the alternative, to apply a narrower construction: “a combination of time and frequency units designed according to the application requirements of the application that is being grouped.”

IX. Overview of the Technology

46. The patent and the prior art references all relate to technology covered by the ever-evolving IEEE 802.16 working group standard.

47. In 1999, the Institute of Electrical and Electronics Engineers (“IEEE”) starting a working to develop a standard for broadband wireless access. Eklund at 1.¹ IEEE published the first iteration of the 802.16 standard in 2001 (IEEE Std 802.16-2001), followed by 802.16c-2002, 802.16a-2003, and, by the time of the invention, revision 802.16-2004, which incorporated and superseded its predecessors. Exs. 1016-1017; 802.16-2004 (Ex. 1006). 802.16-2004 published on October 1, 2004. Ex. 1007 ¶ 11. Around the same time, in the 2003-2005 timeframe, the working group was developing 802.16e-2005. Eklund at 19, 22.

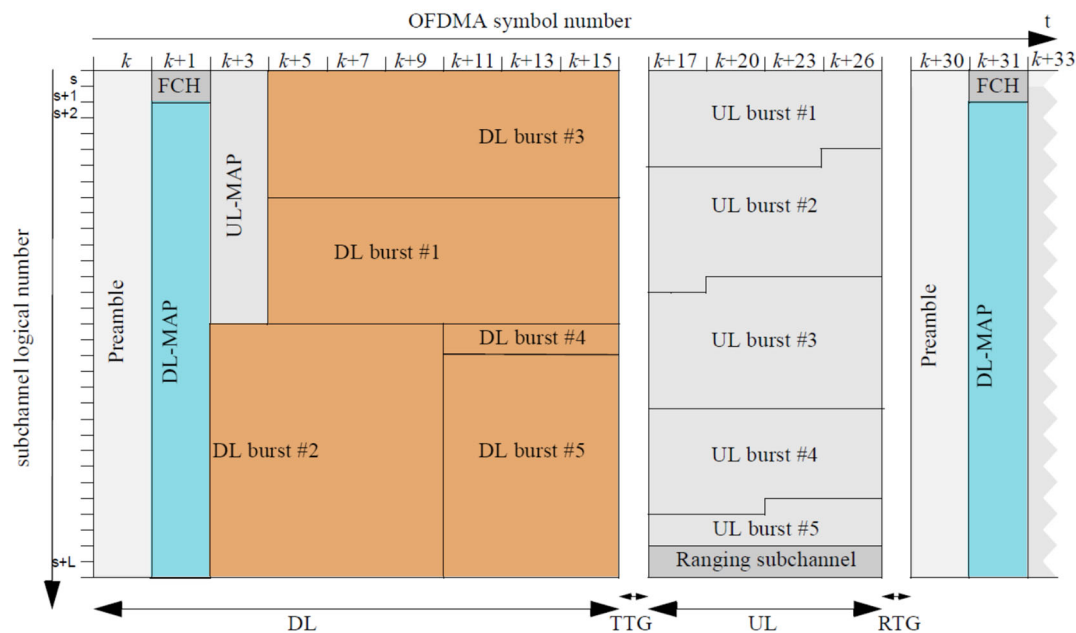
48. Broadband wireless access encompasses a large number of features, but, generally, relates to transmissions from base stations to subscriber stations (downlink) and from subscriber stations to base stations (uplink). These transmissions have both frequency and time components. Frequency can be

¹ All citations to Eklund refer to the original pagination.

described in terms of subcarriers and subchannels and time can be described in terms of slots and OFDM (or OFDMA) symbols.

49. The acronym OFDM refers to orthogonal frequency-division multiplexing, where data is transmitted using multiple subcarriers that are mathematically orthogonal in frequency, permitting more efficient use of data bandwidth. OFDMA refers to orthogonal frequency-division multiple access, which, as the name implies, is an OFDM system to accommodate multiple access corresponding to multiple users.

50. The transmission is organized in “frames” of time and frequency. 802.16-2004 sets for an exemplary frame structure. 802.16-2004 at 500.²



² All citations to 802.16-2004 refer to the original pagination.

51. To ensure that data is received properly, for example, by the subscriber station on the downlink, the transmissions include allocation information to provide the information necessary for synchronization and control, including coding rate, modulation types, start burst time, and burst content. Eklund at 75, 300. Some of these values can be represented using a modulation and coding scheme (MCS). The base station transmits this information to a subscriber station through the DL-MAP, prior to the data transmission. Eklund at 75. It is this stage and aspect of data transmissions that the '450 patent and the prior art relate to.

52. IEEE 802.16 provides a standardized syntax for downlink resource allocation information via DL-MAP IE—downlink Map Information Element. 802.16-2004 at 110, Table 97; *see also* Eklund at 301.

53. As described in more detail below in the context of the '450 patent and prior art, the DL-MAP IE can include connection identifiers (CIDs) that identify the relevant subscriber station.

X. Petition Grounds and Prior Art Combinations

A. Overview of the Prior Art and Other Evidence

1. Park

54. U.S. Publication No. 2006/0039274 A1 (“Park”) is titled “Method for Discretely Indicating Resource Allocation Information and a Method for Reducing Load When Indicating Resource Allocation Information. *See* Park (Ex. 1005) at Cover. Park identifies Won-Hyoung Park and Sang-Boh Yun as the inventors and

was published on February 23, 2006. *Id.* The U.S. application was filed on July 20, 2005 and the original South Korean application (KR 65099/2004) was filed on August 18, 2004. *Id.*; Park Translation (Ex. 1008) at 020.

55. I understand from counsel that Park is prior art to the '450 patent.

56. Like the '450 patent, Park begins with an 802.16-based system. Park [0007], [0013]. Specifically, Park identifies 802.16-2004 and WiBro. Park [0007], [0013]. WiBro was a South Korean mobile wireless service designed to provide wireless broadband access to devices moving up to 60-70 kilometers per hour. Ex. 1024. In July 2004, following exchanges with the IEEE 802.16 working group, the South Korean government announced WiBro would adopt 802.16 as its standard. Ex. 1024; Eklund at 379.

57. At the time the original Park application was filed in August 2004, WiBro had announced its adoption the 802.16 standard and 802.16-2004 was in draft form with the final version to be published October 1, 2004. Ex. 1017; Ex. 1024. The IEEE publication history shows that Draft 5 had been released (on May 13, 2004) and also approved by the standards board (on June 24, 2004). Ex. 1017. Draft 5 is the substantially final draft that would ultimately be published as the 802.16-2004 standard. Ex. 1017.

58. Park then presents an improvement to those mobile communications systems. Park [0005], [0007], [0013].

59. Park specifically builds upon and relies on the existing features of the 802.16-2004 standard, including “DL(/UL)-MAP IE” and “RCID_IE” (a reduced connection identifier), both of which are set forth in the 802.16 standard, including, specifically, in 802.16-2004. Park [0013]-[0015], Table 1; *see also* 802.16-2004 at 110-111 (Table 97). These values were well-known to be associated with and defined in 802.16 and a POSA would recognize these as references to 802.16-2004.

60. Park even incorporates Table 97 of 802.16-2004 into its specification, in the form of Table 1 as a starting point. Park [0013]-[0015], Table 1; *see also* 802.16-2004 at 110-111 (Table 97). Park refers to this table as “Table 95,” but a POSA would readily recognize, in particular, by the title of the table (“H-ARQ Compact DL-MAP IE format for band MAC”), that this is Table 97 from 802.16-2004. “Table 95” as presented in Park is identical to Table 97 from 802.16-2004. As described above, at the time of the original Park application, 802.16-2004 was in the draft stage. Based on my experience with IEEE working groups, it is not unusual for small changes, such as a shift in table numbering, to occur prior to publication of the standard.

61. Working within the 802.16 framework (which includes WiBro), Park then proposed reduced overhead through the use of an allocation scheme. Park [0072]-[0073]. By reducing overhead, Park means (as would be understood by a POSA) that it reduces the number of bits needed. *See also id.*

62. The allocation scheme in Park involves indexing the total available resource into “allocation units.” Park [0043]. Park provides examples of this indexing in Figures 3A to 3C, and as Park indicates and a POSA would understand, there would be more options for the size and shape of the allocation units. Park [0043], [0045]-[0046].

63. Park then uses an index value to identify a given allocation unit. Park [0049]. For Figure 3C, for example, Park explains that “an index value of the allocation unit c is in a range of $c(0)$ to $c(M-1)$.” Park [0049]. Basically, the index value counts the number of allocation units. Using this method, a POSA would know how to describe a resource allocation region for a given subscriber using an index. Park gives several examples, one of which is that a particular resource allocation region can be “represented as $c(0)$ and $c(1)$.” Park [0053]. This would apply to the other indexing shown in Figures 3A through 3D and other resource allocation region sizes and shapes. The idea is that the indexing overlays onto the available resource region and a POSA can identify indexed allocation units needed to describe a resource allocation region using the indices.

64. In addition to indexing allocation units, Park also uses allocation modes. Park provides three such allocation modes in Figures 5A through 5C: allocation mode “00,” “01,” and “10,” where those values represent the binary code used to transmit the information about what mode the system will be operating in.

This binary representation allows Park to input the allocation mode information into the DL(/UL)-MAP IE from 802.16-2004. Park [0075]-[0079], Table 2. For example, Table 2 shows “AM=10,” which refers to allocation mode “10,” the allocation mode shown in Figure 5C. Park [0059], Fig. 5C, Table 2.

65. Figure 5B shows an example for allocating a resource region with continuous allocation units. As shown in Figure 5B and explained in Park, the allocation region (shaded portion of the figure) is made of “allocation units 511, 512, and 513.” Park [0070], Fig. 5B. The region can be described in terms of its “start allocation unit,” represented by index “j” as well as the number of allocation units “3.” Park [0070], Fig. 5B.

2. 802.16-2004

66. As noted above, 802.16 includes a family of standards. The term “802.16” refers to the working group that developed this family of standards, and drafts and standard publications from that working group are named and published with that working group number. When the term “802.16” is used, a POSA would understand this to refer to all of the 802.16 standards, including the most recently published versions, prior versions, and ongoing drafts. As 802.16-2004 itself explains, 802.16-2004 “revises and consolidates IEEE Std 802.16-2001, IEEE Std 802.16a-2003, and IEEE Std 802.16c-2002,” which are the 802.16 standards published prior to the 802.16-2004 version. 802.16-2004 at 4.

67. At the time of the earliest priority date for the '450 patent, 802.16-2004 was the operative standard, having published on October 1, 2004.

68. While 802.16 is the term for the standard, 802.16 is not, by itself a system. One system (the most well-known and widespread system) that uses the 802.16 standard is WiMAX (Worldwide Interoperability for Microwave Access). Eklund at 357-58. The '450 patent specifically identifies WiMAX as an exemplary system. '450 patent at 1:42-45. As discussed above, 802.16 is also not a service like the South Korean WiBro service that adopted the 802.16 standard.

69. The 802.16-2004 standard, like all 802.16 standards, aims to provide flexibility for the various companies adopting and implementing the standards. As a result, it includes a wide range of options for structures, features, and formats. 802.16-2004 at vii-xviii. As noted above, the '450 patent relates to a relatively narrow set of features of the 802.16-2004 standard. This overview is therefore focused on those features.

70. The '450 patent relates to the downlink portion of the transmission, where the base station transmits data to the subscriber station, which 802.16-2004 covers. 802.16-2004 at 8, 31, 207. For example, 802.16-2004 provides specifications for the MAC layer on the downlink and a H-ARQ protocol for the downlink.

71. MAC stands for “medium access control.” The MAC sublayer relates to the part of the data link communication protocol that controls access to the physical transmission medium (also known as the physical layer or PHY). In other words, the MAC layer controls how payload data is transmitted in the physical medium resources available to the system.

72. H-ARQ is part of the MAC sublayer and stands for “hybrid automatic repeat requests.” H-ARQ is a mechanism to deal with packet errors. In a traditional ARQ (“automatic repeat request”) system, when a message is received in error, the receiver (component of the device receiving the data transmission) will automatically request that the transmitter of that message re-send the same message. Eklund at 90-92. In a system using H-ARQ, both forward error correction (“FEC”) and retransmission are employed. When a message is corrupted, the receiver will first try to correct the message itself before asking the transmitter to re-send the same message. Eklund at 92-93.

73. As the ’450 patent and Park both note, 802.16-2004 provides the syntax and variables for DL-MAP IE (downlink map information element), a MAC message that the base station selects and then transmits to the subscriber station. 802.16-2004 at 7, 110-111 (Table 97). As shown in 802.16-2004, one of the entries is for CID (connection identifier) or RCID (reduced connection identifier). 802.16-2004 at 7, 105, 110-111. As its name indicates, the CID identifies the

connection between the base station and the subscriber station. An RCID is a type of CID and can be used instead of a generic CID.

XI. Ground 1: Claims 7 and 11 Would Have Been Obvious Over Park in View of 802.16-2004

74. I explain below, on an element-by-element basis, that a POSA would have concluded that every element of claims 7 and 11 of the '450 patent would have been taught by Park alone or in combination with 802.16-2004. I also explain why a POSA would have considered it obvious to implement Park on a system based on 802.16 using the 802.16-2004 standard throughout the analysis.

75. Park teaches a way of reducing the overhead needed for resource allocation by dividing the time-frequency resource into indexed allocation units and describing the resource region needed for the transmission to a given subscriber station in terms of those indexed units. For example, a given resource region can be expressed in terms of the index of the starting allocation unit and the number of required allocation units. Park explains that this approach can be incorporated into systems that implement the 802.16-2004 standard. Accordingly, a POSA would have found it obvious to implement Park using the 802.16-2004 standard, to which Park specifically directs a POSA.

A. Reasons to Implement Park Using 802.16-2004

76. My analysis in this section applies to my opinion regarding all limitations of claims 7 and 11 of the '450 patent.

77. A POSA would have considered it obvious to implement Park using 802.16-2004. Park discloses an improvement to resource allocation in “[n]ext generation mobile communication systems” and identifies the 802.16-2004 as the baseline for this improvement. Park [0005], [0075]-[0079]. Park even expressly says just that; that its improvement “can be applied to the Wibro or IEEE 802.16 standards in various manners” and specifically references 802.16-2004 as the relevant iteration of 802.16. Park [0075]-[0079].

78. In fact, the improvement in Park is based on both the DL-MAP IE formatting and allocation modes directly from 802.16-2004.

79. As Park explains, its improvements can be implemented through the DL-MAP IE formatting from 802.16-2004. Park starts off by explaining the DL-MAP IE formatting in 802.16-2004 and its use—for indicating resource allocation in the AMC area. Park [0013]-[0014]. Park then provides a copy of Table 97 (as explained above, this is the correct table number in 802.16-2004) from 802.16-2004 to show the DL-MAP IE formatting from the standard. Park [0013]-[0014] (Table 1); 802.16-2004 at 110-111 (Table 97, same as Park’s Table 1).

80. Park then describes the subchannel allocation modes in 802.16-2004. Park [0017]-[0018], [0037]. As Park, notes, the subchannel allocation mode is a variable in the DL-MAP IE format in 802.16-2004. Park [0017]-[0018], Table 1;

see also 802.16-2004 (Table 97, same as Park's Table 1). Park's Table 1 shows an exemplary "Allocation Mode" of "00." Park Table 1; *see also* Park [0020].

81. After establishing this background and explaining the status quo of 802.16-2004, Park then offers an improvement in the form of an allocation scheme.

82. As described above, Park divides the time-frequency resource into allocation units and regions in order to reduce overhead relative to the 802.16-2004 scheme. Park [0072]-[0074]. Park specifically explains that "[t]he present invention can be applied to the Wibro or IEEE 802.16 standards in various manners." Park [0075]-[0079], [0085]. Park then provides an updated version of Table 97 from 802.16-2004, updating the DL(/UL)_MAP IE fields to achieve its improvements. Park [0055]. Park shows these changes in Table 2. *Id.*

83. A POSA would have also looked to Park to both reduce overhead and improve flexibility in an 802.16-based system. Not only does Park directly reference 802.16-2004, but also explains specifically that its invention will reduce overhead and improve flexibility relative to the existing 802.16-based systems. Park [0031], [0073]-[0074].

84. A POSA would have also had a reasonable expectation of success in combining Park and 802.16-2004 because Park directs a POSA to use 802.16-2004 to implement its improvements and provides four specific examples of how to attach, add, or plug-in its invention to an 802.16-2004 system. Park [0075]-[0079].

I note that a POSA would not have needed Park's "how-to" instruction, but that it gives the POSA a "head start" in implementing the system.

85. Incorporating Park's invention into a system based on the existing 802.16-2004 standard would allow a system component implementing Park's invention alongside components complying with the 802.16-2004 standard generally. Accordingly, Park identifies where a POSA could implement its improvements into 802.16-2004 without altering other portions of an 802.16-based system.

86. Specifically, Park first indicates that its invention can be added by providing a "new type" indicating Park's own MAP_IE scheme, which can be added to an extension mode of the "DL_MAP IE TYPE" field shown in Table 89 of 802.16-2004. Park [0076]. While Park refers to "Table 87," as described above, Park's table numbers appear to be two off from the final, published version of 802.16-2004. A POSA would understand the possibility that table numbers have changed slightly and realized that Table 89 in 802.16-2004 contains the referenced information, including because of the title of the table, "Compact_DL-MAP IE types," in 802.16-2004.

87. The second option Park presents is "using a reserved value of DL_MAP IE TYPE" in the same table. Park [0077].

88. The third option Park presents is to represent the invention by “using 1 bit of reserved field” in the DL_MAP IE set forth in Table 97. Park [0078]. Note again that Park’s table numbers are two off and refers to “Table 95.” Regardless, as explained, a POSA would understand Park to be referencing Table 97.

89. The fourth option Park presents is to “new define” Table 97 to include both Park’s MAP_IE scheme and the conventional scheme. Park [0079].

90. A POSA would understand that each of these changes would work in a system based on the 802.16-2004 standard without affecting other aspects of the system.

91. The changes Park proposes are limited to altering the format of the DL-MAP. Specifically, Park describes adding the variables “AUT” (allocation unit type) and “AM” (allocation mode) to a revised DL-MAP IE format. The first two options provided by Park (summarized above), use Compact DL-MAP Type 6 (“reserved”) and Type 7 (“Extensions) from 802.16-2004. Park [0076]-[0077]; 802.16-2004 at Table 89 (referred to as “Table 87” in Park, which is provided below).

Table 89—Compact_DL-MAP IE types

Compact DL-MAP Type	Description
0	Normal subchannel
1	Band AMC
2	Safety
3	DIUC
4	Format_Configuration_IE
5	H-ARQ_ACK_BITMAP_IE
6	<i>reserved</i>
7	Extension

92. As the descriptions imply, Type 6 and Type 7 are not used in the regular operation of a 802.16-based system. Adding Park’s invention to those values will therefore not affect the remainder of the system’s operations. And, as their inclusion in Table 89 indicates, 802.16-2004 expressly contemplates providing additional information about the downlink transmission through those types.

93. Adding new information to Type 6 and Type 7 also would not affect the operation of the overall system. Base stations and mobile stations operating according to 802.16-2004 without the improvement disclosed in Park will use Types 0-Type 5, which Park leaves unchanged.

94. Similarly, the third option Park provides uses “1 bit of a reserved field in Table 95” (Table 97 in 802.16-2004, included as Table 1 in Park). 802.16-2004 expressly reserves two bits “set to zero” in its own systems and Park proposes

leveraging one of those two otherwise unused bits. *Compare* Park Table 1 with Park Table 2.

95. The fourth option Park provides is to “newly define” Table 97 of 802.16-2004 so that it can “indicate the scheme of the present invention as well as the conventional scheme.” Park [0079]. In other words, while the DL-MAP IE format would be new, it will still allow for the same operations as and compatibility with 802.16-based systems that do not implement Park’s improvements.

96. A POSA would also understand that all of these changes would work equally well in a system (like WiBro) that expressly contemplates mobile stations, including WiBro mobile stations moving at 60-70 km/h.

97. While the title of 802.16-2004 refers to “*Fixed* Broadband Wireless Access Systems,” the application of 802.16-2004 is not so limited. As explained above, WiBro, which touted its ability to cover mobile subscriber stations, adopted the 802.16 standard back in July 2004.

98. Additionally, around the same time, the 802.16 working group was drafting 802.16e, which was approved in December 2005, and would publish as 802.16e-2005 and an Amendment and Corrigendum to 802.16-2004 on February 28, 2006. 802.16e-2005 (Ex. 1014); Ringle Decl. (Ex. 1007); Eklund at x (referring to 802.16e-2005 as “adding mobility support”), 10, 22 (showing the timing of the development of the 802.16 working group standards).

99. 802.16e is titled “Air Interface for Fixed *and Mobile* Broadband Wireless Access Systems, Amendment 2: Physical and Medium Control Layers for Combined Fixed and Mobile Operation in Licensed Bands.” 802.16e-2005. Specifically, 802.16e notes that it “provides enhancements to IEEE Std 802.16-2004 to support subscriber stations moving at vehicular speeds”—like subscriber stations in a WiBro system. *Id.* at 1.

100. In providing those enhancements, 802.16e does not alter the DL_MAP IE relied on by Park to implement its invention in the 802.16 standard. 802.16e provides a Corrigendum indicating the changes relative to 802.16-2004. Table 97, on which Park relies, is substantially the same. 802.16e at 89-90 (Table 97). The Corrigendum shows a handful of additions to the DL-MAP IE format relied on by Park, but none of them relate to Park’s invention or affect the implementation of Park in an 802.16-based system. *Id.* Specifically, 802.16e adds syntax for “HARQ mode” variables (“if (HARQ mode = 0), “else if (HARQ mode = 1),” and, within the “else if” syntax, variables for “Shortened DIUC” and “Companded SC”). *Id.* As 802.16e explains, HARQ mode is an optional feature to support “Multiple HARQ,” for checking and repeating commands. *Id.* at 634. The remainder of Table 97 remains unchanged, including the features used by Park for implementing its invention.

101. The combined facts that: (1) 802.16e was underway at the time of the invention, (2) that Park explicitly references WiBro (a system focused on mobile devices moving at 60-70 km/h), and (3) that the later-published 802.16e uses the exact same DL-MAP IE formatting that Park proposes to revise in order to implement its invention in 802.16-2004, all reinforce my conclusion that Park's changes to 802.16-2004 will apply to mobile devices, including mobile devices moving at vehicular speeds.

B. Independent Claim 7

1. Preamble

102. The preamble of claim 7 recites: “[a] mobile device in a wireless packet system using a frame structure of multiple frames for transmission, each frame comprising a plurality of time intervals, each time interval comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols and each OFDM symbol containing a plurality of frequency subcarriers, the mobile device configured to: . . .” ’450 patent cl. 7.

103. I have been asked by counsel to assume the preamble is limiting and determine whether Park in view of 802.16-2004 discloses the preamble. It does.

i. Frame Structure

104. The first part of the preamble is: “A mobile device in a wireless packet system using a frame structure of multiple frames for transmission, each frame comprising a plurality of time intervals, each time interval comprising a plurality

of orthogonal frequency division multiplexing (OFDM) symbols.” Park in view of 802.16-2004 discloses this limitation.

105. To start, the ’450 patent explains that these features were disclosed in the 802.16-2004 standard. ’450 patent at 1:34-2:16. The ’450 patent states:

able to provide a high degree of flexibility. However, in order to support such flexibility, additional overhead is usually required. For example, in a wireless system based on the IEEE 802.16 standard (“WiMAX”), multiple packet streams are established for each mobile station to support different applications. At the medium access control (MAC) layer, each packet stream is mapped into a wireless connection. The MAC scheduler allocates wireless airlink resources to these connections. Special scheduling messages, DL-MAP and UL-MAP, are utilized to broadcast the scheduling decisions to the mobile stations.

In the MAP scheduling message defined by IEEE802.16, there is significant control overhead. For example, each connection is identified by a 16 bits connection ID (CID). The CID is included in the MAP message to identify the mobile station. The maximum number of connections that a system can support is therefore 65,536. Each mobile station has at least two management connections for control and management messages and a various number of traffic connections for application data traffic. As another example,

106. Park and 802.16-2004 confirm.

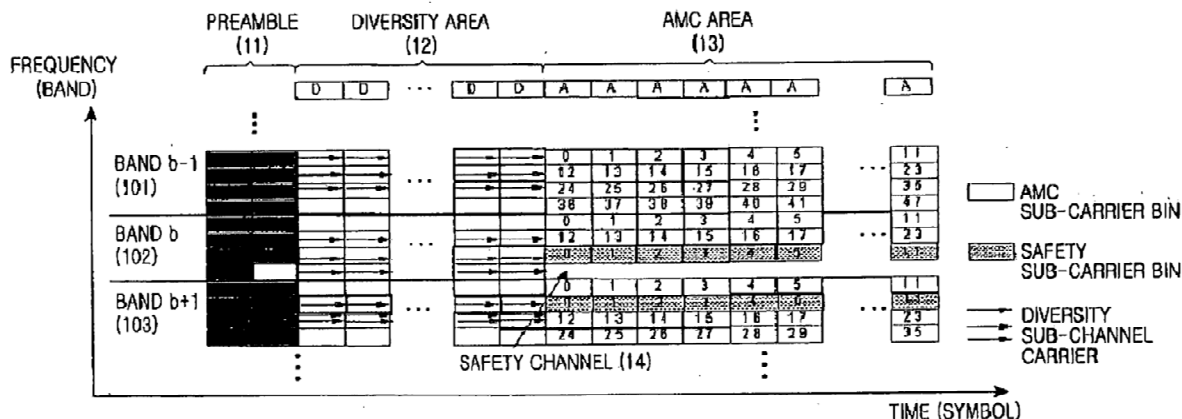
107. Park discloses an “Orthogonal Frequency Division Multiple Access wireless network system” that constitutes the claimed “wireless packet system.” Park Abstract, [0003] (referring to an OFDMA “wireless communication system”), [0033], [0015], [0057]. From this description, a POSA would have already understood that Park refers to a “wireless packet system.” Further supporting this conclusion, Park also references “encoder packets.” Park Table 1, Table 2.

108. As explained above “Orthogonal Frequency Division Multiple Access” or “OFDMA” is a multiple access version of OFDM; in other words, it allows multiple users in an OFDM system. OFDMA still transmits data over OFDM symbols, as claimed in the preamble.

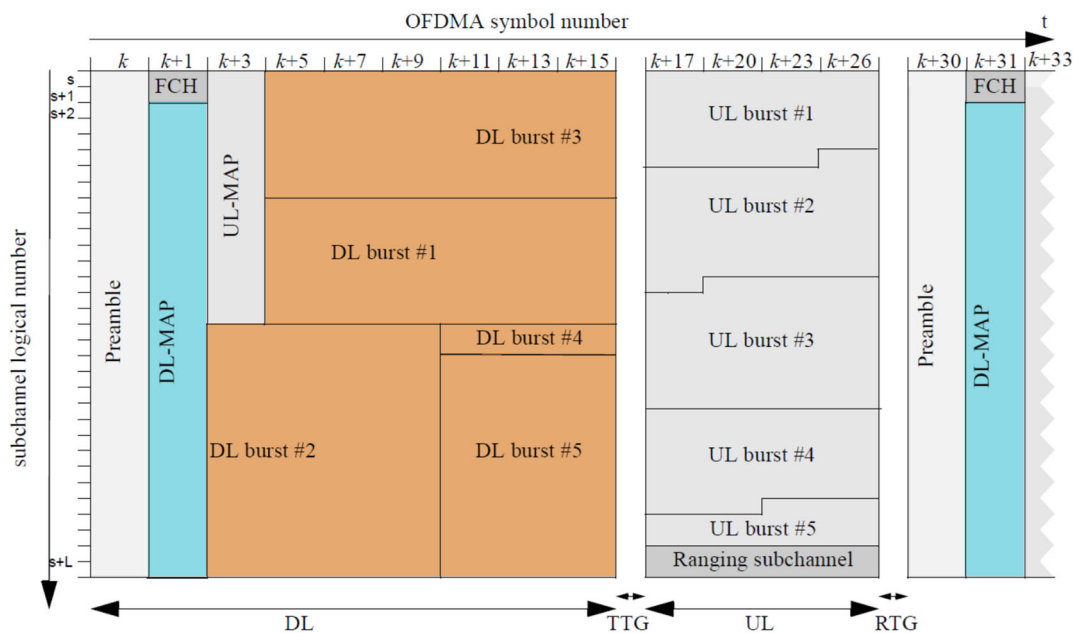
109. In addition and as explained above, Park directs a POSA to implement its improvements on an 802.16-based system. Park [0075].

110. 802.16 itself confirms the ’450 patent’s description of the standard: that it is for wireless packet systems. 802.16-2004 at 267. 802.16 refers to “encoder packets” as noted in Park, which are sent from the base station to the subscriber station. *Id.*

111. Park and 802.16-2004 also disclose “using a frame structure of multiple frames for transmission.” As Park explains, it shows the frame structure of an 802.16 or WiBro-based system in Figure 1. Park [0007], [0036]. Park Figure 1 only shows one frame, but a POSA would readily understand that in broadband wireless access systems, there are additional frames.



112. 802.16-2004 confirms this, showing another depiction of a frame structure in its Figure 218. 802.16-2004 at 500, Fig. 218. Figure 218 depicts a first frame from OFDMA symbol number k through $k+26$ and a second frame starting at $k+30$. As Figure 218 indicates, this pattern continues



113. Figure 218 shows the sections of an OFDMA frame that are mandatory under the 802.16 standard. As shown, these sections include a

preamble, DL-MAP, UL-MAP, DL bursts, UL bursts, and a ranging subchannel. The preamble typically contains information needed for synchronization. Eklund at 77. As described above, the DL-MAP is for resource allocation in an AMC area of the OFDMA frame. 802.16-2004 at 574. The DL burst contains the corresponding data transmitted by the base station to the mobile station. Eklund at 78, 248.

114. As 802.16-2004 explains, this frame structure presented in Figure 218 can be used for multiple zones, including the AMC zone (also referred to as the AMC area). 802.16-2004 at 500. Figure 219 in 802.16-2004 depicts these zones.

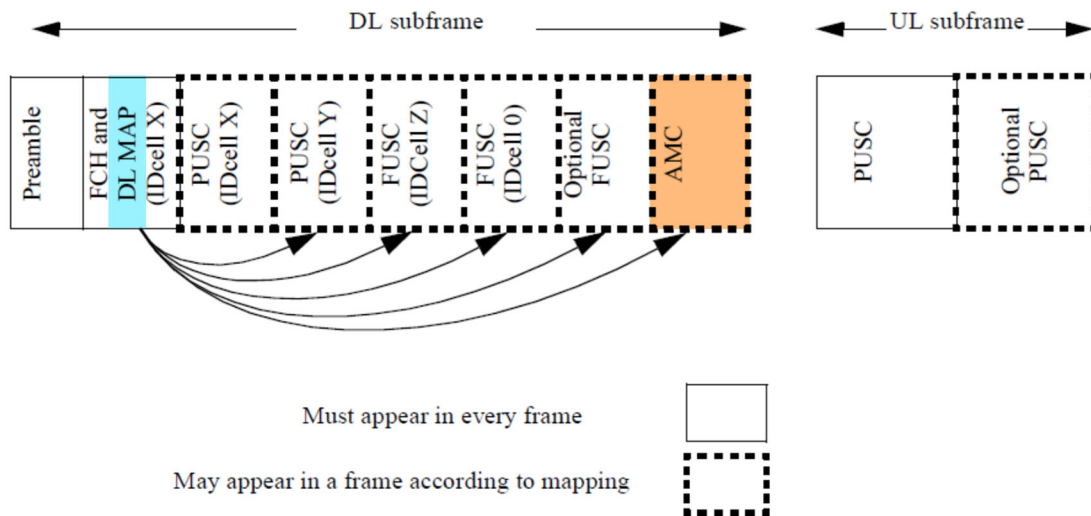


Figure 219—Illustration of OFDMA frame with multiple zones

115. As shown above, in the downlink subframe of the OFDMA frame, a preamble and DL MAP (highlighted in blue) are required for each frame. 802.16-2004 at Fig. 219; *see also* 802.16-2004 at 500 (describing Figure 219 as showing an “OFDMA frame with multiple zones”). As Park indicates, its

improvements to 802.16-2004 relate to the application of the DL-MAP IE (highlighted in blue) to the optional AMC zone (highlighted in orange).

116. AMC stands for “Adaptive Modulation and Coding” and the AMC permutation sometimes referred to as “adjacent subcarrier permutation.” *E.g.*, Park [0010]; ’450 patent at 10:62-64; Eklund (Ex. 1025) at 293. AMC allows the system to change the modulation and coding scheme in response to varying channel conditions. In good channel conditions, AMC permits a faster modulation scheme and high coding rate; in bad channel conditions, the system uses a slower modulation scheme and lower coding rate to ensure that the communication is maintained. *E.g.*, Falahati (Ex. 1027). This greatly improves data communication efficiency, especially in systems with mobile stations where there is likely to be greater variation in channel conditions.

117. 802.16-2004 describes AMC as “optional” for both the downlink and the uplink. 802.16-2004 at 574. But given the benefits (particularly for mobile subscribers), it is preferable to use an AMC zone whenever possible.

118. AMC zones are also used in AAS, another optional feature of 802.16-2004. 802.16-2004 at 505-507, 574-575. “AAS” refers to adaptive antenna systems where the antennas in the mobile communication system are adjusted to enhance performance. Eklund at 45-46. For example, the system can select the

best antenna for a particular transmission or actively steer a transmission beam to the receiving mobile device (among other options). *E.g.*, Eklund at 45-46.

119. When AAS is used, the system uses a “superframe” structure, which is a large frame of up to 1 second in time. 802.16-2004 at 574-575; Eklund at 320. As 802.16-2004 teaches, an AAS superframe must begin with at least 20 regular frames (which will include the DL-MAP as described above) but then has up to 200 ms of AAS-only periods without DL-MAP or other control periods before again having a regular frame with a DL-MAP. Eklund at 320. In this way, an AAS superframe reduces overhead and increases capacity in the AAS-only periods (that do not have a DL-MAP). 802.16-2004 at 574 (setting forth the requirements for the AAS superframe); Eklund at 320. The end result is that the base station can spend up to 95.2% of its time in the increased-capacity AAS-only mode. Eklund at 320. This makes using AAS desirable when possible, for example, when all of the mobile devices are AAS-enabled.

120. The AAS superframe can use the AMC permutation (also referred to as the “adjacent subcarrier permutation”) and therefore can have AMC zones. 802.16-2004 at 574; 802.16-2004 at 507, Fig. 224 (showing the frame structure for “AAS on AMC Permutation” on the downlink). 802.16-2004 explains that the base station “may change . . . to the adjacent subcarrier permutation when changing from non-AAS to AAS-enabled traffic.” 802.16-2004 at 574. Combining AAS

and AMC will result in a system with the benefits of both: increased capacity and increased efficiency.

121. Park and 802.16-2004 also disclose each of the above-described frames “comprising a plurality of time intervals each time interval comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols.” As shown in both Park Figure 1 and 802.16-2004 Figure 218, the frames have time (in symbols) along the x-axis. Figure 218 in 802.16-2004 then shows time intervals of two OFDMA symbols. As described above and labeled in the figure, k indicates the OFDMA symbol number. Figure 218 shows two OFDMA symbol intervals, indicating that the k values (symbol number) counts up by two in the downlink. See Figure 218 (showing intervals of $k+1$, $k+3$, $k+5$, etc.); 802.16-2004 at 497-98 (confirming that each slot spans two OFDMA symbols in time).

122. Divisions of time into intervals also occurs in the AMC zones. After describing the “minimum possible data allocation unit” for AAS/AMC subchannels (referring to “adjacent subcarrier permutation,” another term for the AMC permutation, and citing section 8.4.6.3 on AAS/AMC subchannels), 802.16-2004 explains that an OFDMA data region is an allocation of a group of contiguous subchannels in a group of contiguous OFDMA symbols. 802.16-2004 at 496. A group of contiguous OFDMA symbols is a time interval.

123. Consistent with 802.16-2004, Park also explains that it divides the time component of the frame into “a plurality of time slots,” for example, 20 to 30 time slots. Park [0006]. A “slot” is different from an OFDM symbol and, in fact, includes OFDM symbols. *E.g.*, 802.16-2004 at 496.

124. Unsurprisingly, these divisions of time are consistent with the divisions of time in the ’450 patent, which explains that a “frame consists of a number of time slots” where “each time slot is comprised of one or more OFDM symbols.” ’450 patent at 4:64-66, Fig. 3.

ii. Mobile Device

125. Park also discloses “[a] mobile device” in that wireless packet system. Park uses the phrases “subscriber” or “terminal” to refer to the claimed mobile station. Park Abstract, [0005]-[0006], [0031]-[0033]. This is consistent with the 802.16-2004 standard, which uses the phrase “subscriber station” or “SS.” 802.16-2004 at 11 (using the term “subscriber station (SS)”).

126. While Park and 802.16-2004 do not expressly state the “subscriber” or “terminal” is a mobile device, a POSA would understand that both Park and 802.16-2004 apply to mobile devices—as the ’450 patent acknowledges. ’450 patent at 1:42-45. *See also* Ex. 1022 at 007-08, 012; Ex. 1023 at 004, 009, 012, 024-25; Ex. 1024 (Eklund) at 3-4, 6-7, 24-25, 67-68. As Park states, its improvements relate to “[n]ext generation mobile communication systems.” Park

[0005]. As I describe above, Park also expressly references that its improvements apply to WiBro, South Korea's broadband wireless access service that was well-known to have provided service to mobile devices. Park [0007], [0073]-[0075].

127. Because the DL-MAP is transmitted on the downlink (from the base station to the subscriber), the DL-MAP is transmitted from the base station to a mobile station in a mobile wireless system. As I describe above, the DL-MAP in 802.16-2004 could be (and were, in fact) used for mobile subscribers.

128. The title of 802.16-2004 does not indicate otherwise. While "fixed" in the title of 802.16-2004 appears to connote a *non-mobile* station on its face, a mobile device, in the context of the '450 patent, can be described as fixed or moving. Both Park and the '450 patent acknowledge this feature of systems for "fixed" devices. While the U.S. Park application refers to "fixed subscribers," Park [0011], the original Korean application refers to "*mainly* for stationary users." Park Translation (Ex. 1008) at 022 (emphasis added). A POSA would have been aware of the Park's original-language disclosure as part of the POSA's background knowledge at the time. This is more in line with and confirms that Park's assertion that it applies to WiBro systems and, as I discussed in the preceding paragraph, that Park is targeting "[n]ext generation mobile communications systems." And the '450 patent notes that "mobile devices . . . may be fixed or may roam." '450

patent at 3:40-42. This confirms the general understanding that 802.16-based systems can include mobile devices.

iii. Plurality of Frequency Subcarriers

129. Park and 802.16-2004 also teach “each OFDM symbol containing a plurality of frequency subcarriers.

130. As 802.16-2004 explain, an OFDMA symbol is “made up of subcarriers.” 802.16-2004 at 494-496.

131. For example, for AMC “one slot” (the minimum resource allocation unit) is “one subchannel by one OFDMA symbol.” 802.16-2004 at 496. As explained above, OFDMA is a multiple access version of OFDM. An OFDMA symbol is equivalent to the claimed OFDM symbol. A subchannel has multiple frequency subcarriers. 802.16-2004 at 496 (indicating that subchannels are further defined in § 8.4.6). For AMC, a “subchannel consists of six contiguous bins in a band.” 802.16-2004 at 574 (defining the AMC subchannel within § 8.4.6).

132. Park and 802.16-2004 both describe the division of time-frequency resource into bins, which are relevant here, as well as tiles (another way of describing portions of a frame). An “AMC subchannel shall be defined as a region of 1 bin x 6 symbol slots or 2 bins x 3 symbol slots”. 802.16-2004. As Park and 802.16-2004 both explain, bins and tiles have multiple subcarriers per one OFDMA symbol. Park explains that a bin “includes 9 sub-carriers sequentially

provided in one OFDMA symbol” and a tile “includes 3 to 6 sub-carriers sequentially provided in one OFDMA symbol.” Park [0009].

iv. Configured to

133. As noted above, I understand from counsel that while the claims recite “configured to,” the parties have agreed to construe “configured to” as “designed to.” A mobile device would be designed to perform the recited elements described in the forthcoming sections because the device would be programmed or have software and/or hardware elements designed to perform the relevant operations.

2. Element 1: receive an identifier from a base station

134. Park and 802.16-2004 both disclose a mobile device configured to “receive an identifier from a base station in a cell in which the mobile device is operating.”

135. As the ’450 patent acknowledges, 802.16-2004 discloses a “connection ID,” which is also referred to as a “connection identifier” or “CID.” ’450 patent at 1:52-55; 802.16-2004 at 3, 7.

136. 802.16-2004 also discloses a “reduced CID” or “RCID” that can be used instead of the CID. 802.16-2004 at 105. 802.16-2004 explains that RCID is a “CID Type” that can be used instead of a basic CID to reduce the number of bits needed to transmit the identifier information in the MAP message. 802.16-2004 at 104-105, Table 97.

137. It is this “RCID” option that Park uses. *See* Park [0015], Table 1, [0057], Table 2.

138. As the ’450 patent also acknowledges, the CID (or RCID if the system uses the reduced version) is “included in the MAP message to identify the mobile station.” ’450 patent at 1:48-55.

139. The MAP message (DL-MAP) is broadcasted on the downlink from the base station to the mobile stations prior to the data transmission and defines access to the downlink information. 802.16-2004 at 46, 110-111 (Table 97, DL-MAP IE format for band AMC); ’450 patent at 1:48-55; Park [0013]-[0015] (Table 1, which is Table 97 in IEEE 802.16), [0055]-[0057] (Table 2, Park’s DL-MAP IE format).

140. Both Park and 802.16-2004 include the CID or RCID in the DL-MAP and refer to the value as representing the “assignment of the IE,” where “IE” refers to the “Information Element.” Park [0013], [0015], [0055]-[0057]; 802.16-2004 at 111.

141. The “assignment” refers to the fact that the CID or RCID indicates the mobile device to which the data is being transmitted. 802.16-2004 explains that (as the name implies), a CID or RCID identifies the connection between a base station and a given mobile station. 802.16-2004 at 7, 110-111. Specifically, 802.16-2004 refers to identifying a connection “to equivalent peers in the MAC of

the base station (BS) and subscriber station (SS).” 802.16-2004 at 7; Eklund at 107 (explaining that the MAC uses the CID to identify “all information exchanged” between the base station and subscriber station). As described above, the MAC layer controls access to the PHY. This applies equally to multi-user network access where there is more than one subscriber station (mobile device).

142. In OFDMA there is only one base station in a given cell, but multiple mobile devices. The identification of a connection therefore also identifies the mobile station—the individual mobile station receiving the downlink is the other end of the connection. Eklund at 108 (explaining that the CID is used “to identify an SS”); ’450 patent at 1:48-55 (admitting that the CID is included “to identify the mobile station”).

143. Park and 802.16-2004 also disclose that the mobile devices receives the CID or RCID from a base station as claimed. Park includes an RCID (type of CID) in the DL-MAP IE. Park [0015], Table 1.

144. “DL-MAP” is a message that defines access to the downlink information—the information transmitted from the base station to one or more mobile stations. 802.16-2004 at 8, 46. As described above, the DL-MAP is transmitted by the base station in advance of the data transmission to provide information the mobile stations will need in order to decode the data transmission. Each DL-MAP IE within the DL-MAP contains the RCID/CID that identifies the

mobile station that will read that portion of the transmission. 802.16-2004 at 46, Table 97.

145. Further confirming that the RCID/CID is “from a base station,” 802.16-2004 explains that the CIDs “shall be assigned in the RNG-RSP and REG-RSP messages.” 802.16-2004 at 33. Both the RNG-RSP (ranging response) and the REG-RSP (registration response) messages are generated and transmitted by the base station on the downlink in response to a RNG-REQ (ranging request) or REG-REQ (registration request) messages from a mobile device. 802.16-2004 at 49-52 (explaining that the base station sends and the mobile device receives RNG-RSP and REG-RSP); *id.* at 50 (“An RNG-RSP shall be transmitted by the base station . . .”); *id.* at 50 (including “Basic CID” as a parameter in the RNG-RSP message); *id.* at 52 (“A BS shall generate REG-RSPs in the form shown in Table 22, including . . . CID”).

3. Element 2

146. The second element in claim 7 is “a mobile device configured to . . . receive a signal containing information from the base station over a segment of time-frequency resource, the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a time interval, each unit containing a set of frequency subcarriers in a group of OFDM symbols, where N=2, 4, or 8.” For ease of reference, I will first discuss the sub-

element reciting “receive a signal containing information from the base station over a segment of time-frequency resource.” I will then discuss the two claimed features of the claimed segment “a starting time-frequency coordinate” and “N time-frequency resource units within a time interval” where “N=2, 4, or 8.” Finally, I will discuss “each unit containing a set of frequency subcarriers in a group of OFDM symbols.”

4. Element 2(a): receive a signal over a segment of time-frequency resource

147. Park and 802.16-2004 both disclose that a mobile device configured to “receive a signal containing information from the base station over a segment of time-frequency resource.”

148. Park expressly teaches that its “subscribers” (mobile devices) receive “downstream data,” which refers to information sent from a base station to a subscriber/mobile device. 802.16-2004 describes the same downlink process: the base station sends the signal containing information and the mobile device receives that information. 802.16-2004 at 8, 31; Eklund at 35 (explaining that “downlink” and “downstream” both refer to communication from the base station to the mobile device).

149. Park also teaches that its mobile devices receive the information over a segment of time-frequency resource.

150. The '450 patent describes the claimed “segment” as a portion of the total time-frequency resource, which it shows in Figure 6. '450 patent 6:3-14, Fig. 6. The specification explains that each V_i is a segment, including V_1 (shown in blue in an annotated version of Figure 6 below), V_2 (shown below V_1), V_3 , and so on, all the way up to V_m .

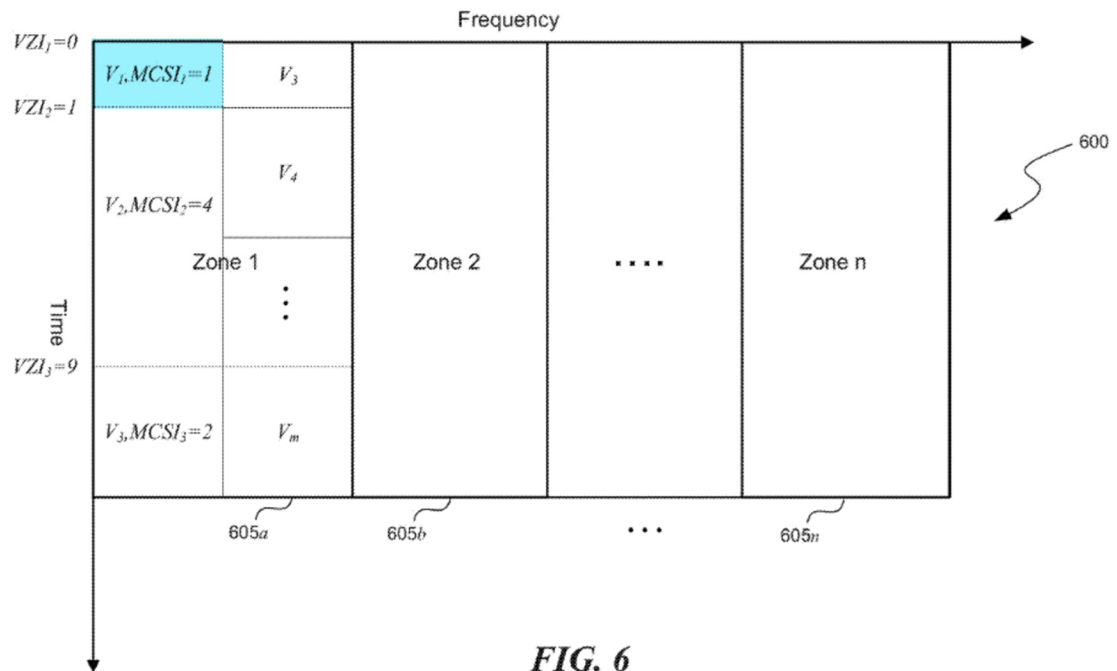


FIG. 6

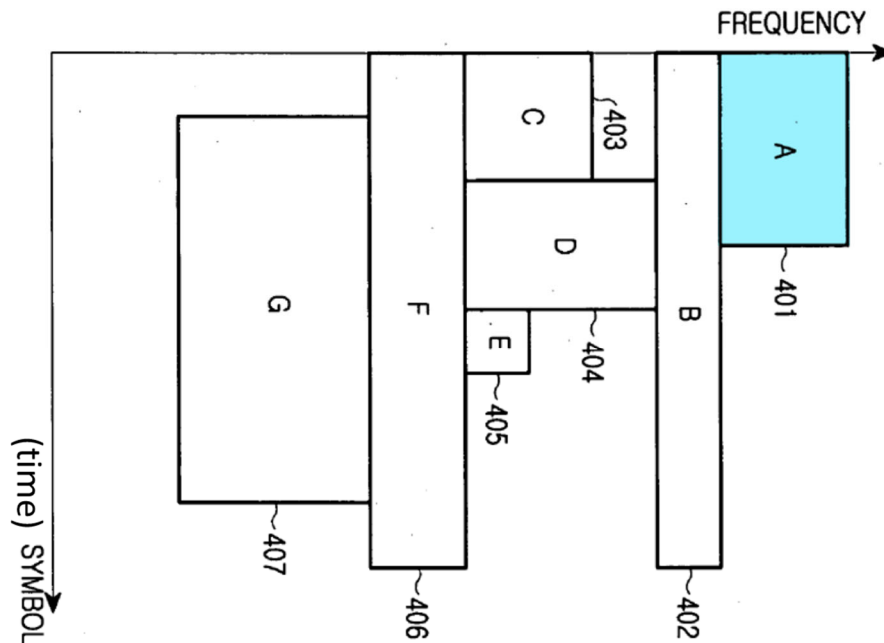
151. The '450 patent also explains that each segment is for a particular packet stream. Using voice transmissions as an example, the '450 patent notes that V_1 is “for the first voice packet stream,” V_2 “for the second voice packet stream,” and so on. '450 patent at 6:3-14.

152. Park teaches the same segments in the same way, just using its own, different terminology. Instead of a “segment,” Park refers to a “resource allocation region.” The resource allocation regions are “for plural subscribers.” Park [0050]-

[0051]. Using the same example as the '450 patent (voice transmissions) each subscriber would be associated with a different voice packet stream. A first subscriber would therefore receive the first voice packet stream.

153. Park even depicts its resource allocation regions in the same way that the '450 patent depicts the claimed segments.

154. Taking Figure 4 in Park and rotating it so that the frequency and time axes are in the same direction as the '450 patent's Figure 6, Park's resource allocation regions of varying sizes (for example region A 401, highlighted in blue) appear the same as the '450 patent's segments (for example segment V₁, highlighted in blue):



155. While Park labels the time axis as the “symbol” axis, the two are equivalent. As described above, a “symbol” is a unit of time.

5. Elements 2(b) and 2(d) – segment having a starting time-frequency coordinate and 2, 4 or 8 time-frequency resource units

156. As noted above in the claim construction section, I was instructed by counsel to apply both constructions for purposes of this analysis. Under both constructions, Park teaches a “time-frequency resource unit.”

157. First, under the plain and ordinary meaning of the term, Park discloses time-frequency resource units. Like the '450 patent, Park uses single-unit-sized divisions of the time-frequency resource that Park refers to as “allocation units.” Park describes its allocation units as “variously defined according to time, frequency, code, and direction of indexing.” Park [0047]. Park also indexes the “total resource region per each allocation unit.” Park [0033], [0038], [0043]-[0044] (“the total resource region is indexed”), [0049]; *see also* Park Abstract (“indexing a total resource region”). In other words, Park takes the entire available time-frequency resource, and divides it into indexed units. *See* Park Translation at 020 (“the entire resource area is indexed by each allocation unit”).³ Park provides four examples of its indexing in Figures 3A-3D (rearranged for ease of reference):

³ A POSA would have been aware of the original-language Park disclosure as part of the POSA’s background knowledge at the relevant time.

INDEX 0
INDEX 1
INDEX 2
INDEX 3
...
INDEX J-2
INDEX J-1

FIG.3A

INDEX 0
INDEX 1
INDEX 2
INDEX 3
...
INDEX K-2
INDEX K-1

FIG.3B

INDEX 0	INDEX 1	INDEX 2	INDEX 3
INDEX 4	INDEX 5	INDEX 6	INDEX 7
...			
INDEX M-8	INDEX M-7	INDEX M-6	INDEX M-5
INDEX M-4	INDEX M-3	INDEX M-2	INDEX M-1

FIG.3C

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
...							
N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1

FIG.3D

158. In Figures 3A through 3D, the outer rectangle represents the total available time-frequency resource, which is indexed according to “allocation units” of different sizes. Park [0046]. In Figure 3A, the total time-frequency resource is indexed from $a(0)$ to $a(J-1)$; in Figure 3B, from $b(0)$ to $b(K-1)$; in Figure 3C from $c(0)$ to $c(M-1)$; and in Figure 3D from $d(0)$ to $d(N-1)$. Park [0049]. An “allocation unit” in Park would be, to provide some arbitrary examples: $a(0)$, $b(K-2)$, $c(7)$ and $d(N-1)$.

159. In Park, the indexed total resource region is the “AMC area” for which the allocation information is provided via the DL-MAP, as described above. Park [0043].

160. Counsel also asked me to evaluate whether Park’s “allocation units” are time-frequency resource units under the narrower construction I mentioned in the claim construction section, namely “a combination of time and frequency units designed according to the application requirements of the application that is being

grouped.” The term “application” refers to the type of data being transmitted, such as audio, video, data, or voice-over-IP. ’450 patent at Abstract, 3:14-18; Eklund at 57.

161. Park explains that the size and shape of its allocation units “can be properly selected according to the type of the system” or, in the original Korean application, “depending on the operation of the system.” Park [0046]; Park Translation at 024.⁴ These disclosures indicate to a POSA to consider the system’s needs for different transmissions when selecting the size and shape of the allocation unit. For example, a POSA would want to maximize throughput through the use of a larger allocation. Eklund at 11-12 (describing that throughput is a “critical requirement” for a system), 58 (explaining that throughput depends, in part, on packet size and overhead).

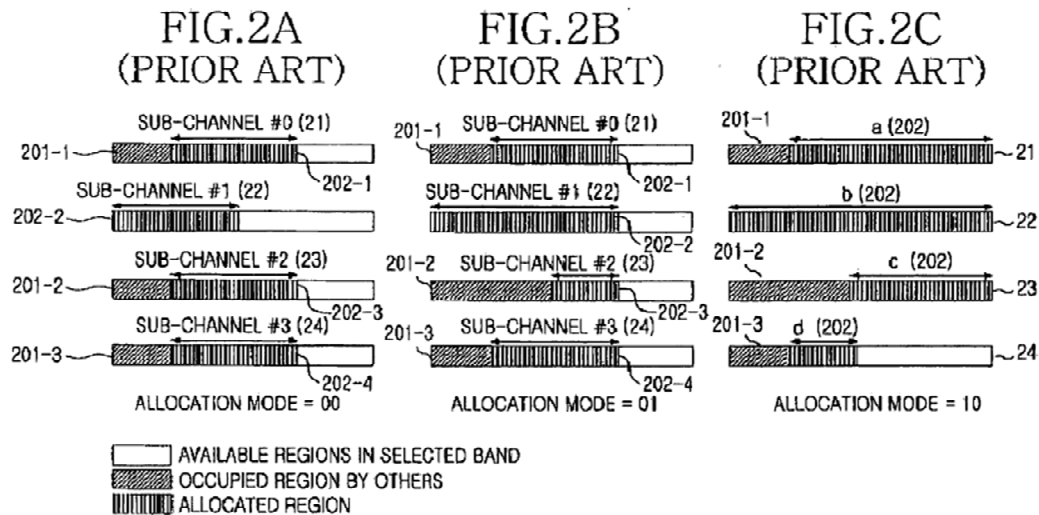
162. Park also discloses “the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a

⁴ As I stated earlier, a POSA would have been aware of the disclosure in the original-language Park as part of the POSA’s background knowledge at the relevant time. This disclosure in the original-language application confirms the POSA’s understanding of Park.

time interval . . . where $N=2, 4, \text{ or } 8$,” where Park’s allocation units constitute time-frequency resource units.

163. As noted above, I understand from counsel that “starting time-frequency coordinate” is to be construed as a “one-dimensional starting time-frequency coordinate” based on the agreement of the parties.

164. One of Park’s improvements to 802.16-2004 is defining allocation modes to reflect new information that can be obtained from Park’s indexing of the total time-frequency resource. As Park explains, it shows prior art allocation modes “00,” “01,” and “10” in Figure 2. Park [0017]. As Park explains, in the 802.16-based prior art system, the two-bit allocation mode groups subchannels. Park [0019]-[0027]; 802.16-2004 at 111. 802.16-2004 describes its allocation modes as “00” referring to “same number of subchannels for the selected bands”; “01” referring to “different number of subchannels for the selected bands”; and “10” referring to the “total number of subchannels for the selected bands determined by N_{SCH} code and N_{EP} code.” 802.16-2004 at 110. Figure 2 in Park is a reproduction of Figure 23 in 802.16-2004 and shows what each of these allocations modes look like in time-frequency space:

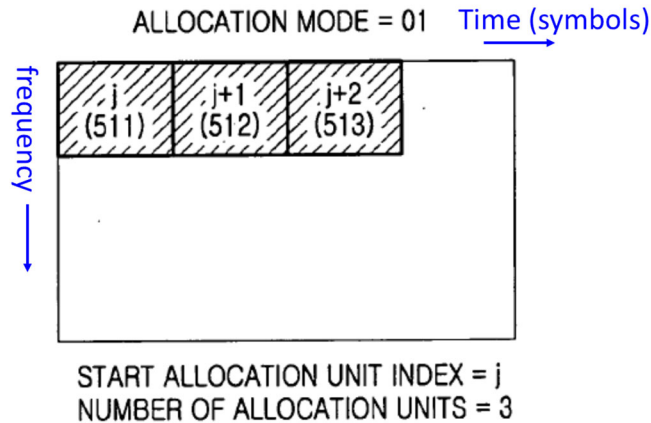


165. The effective result is that systems based on 802.16-2004 (without the improvement in Park) must provide two pieces of information to describe an allocated region: a “Slot (Symbol Offset)” and a “Subchannel offset.” 802.16-2004 at 496, Fig. 215. For example, in Figure 215, 802.16-2004 depicts an exemplary “data region,” which it describes as “a two-dimensional allocation” in both time and frequency. 802.16-2004 at 496.

166. Park, in contrast, redefines allocation modes “00,” “01,” and “10.” Park [0064]-[0067]. Relevant to the discussion here, allocation mode “01” indicates that the “allocation region can be indicated using the index value of the start allocation unit and the total number of allocation units.” Park [0066]. This discloses exactly what the ’450 patent claims: a starting time-frequency coordinate

(index value of the start allocation unit) and N time-frequency resource units (the total number of allocation units).

167. Figure 5B of Park, showing allocation mode “01” shows exactly this (with notations for time and frequency dimensions added for reference):



168. As shown, in Park’s new allocation mode “01,” the resource allocation region (the shaded area) can be expressed as the “start allocation index” of “j” and the number of allocation units of “3.” Park Fig. 5B. Park describes Figure 5B as showing “continuous allocation units 511, 512, and 513 are allocated in the allocation region” and, consistent with Figure 5B, “[t]o indicate the allocation region, ‘j’ which is an index value of a start allocation unit 511 and ‘3’ which is the total number of the allocation units are [sic] used.” Park [0070].

169. Park successfully provides both frequency and time information for the starting point using a single (one-dimensional) integer in the form of the start allocation unit index (“j” in Figure 5B). Park therefore discloses a one-dimensional starting time-frequency coordinate as claimed.

170. As described above, the resource allocation region in allocation mode “01” is also expressed in terms of the “number of allocation units,” which corresponds to “N time-frequency resource units” as claimed.

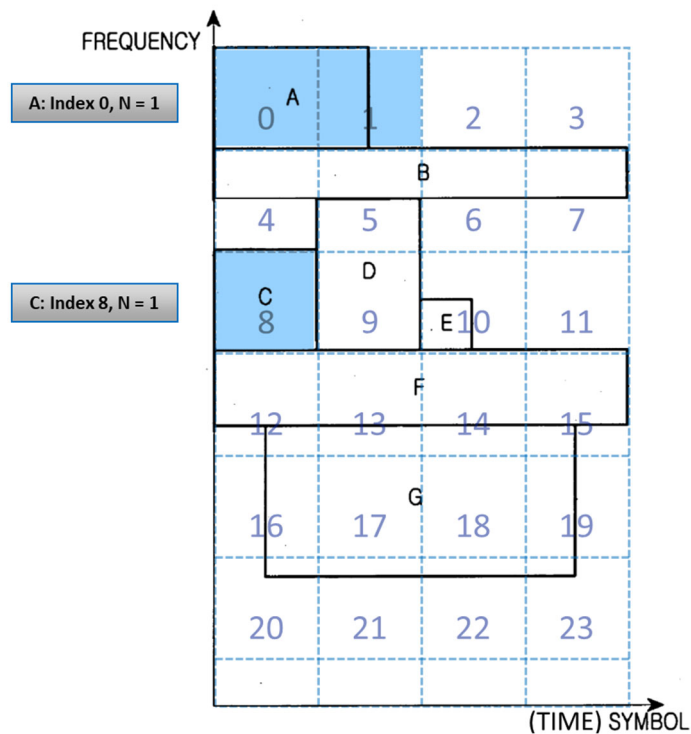
171. While in Figure 5B, the example provided is N=3, Park is not limited to this example. As explained above, Park expressly provides that its allocation units can be different sizes and shapes in order to describe resource allocation regions, indicating that the same resource allocation region could be described in terms of different allocation units and different numbers of those units depending on the size. Park [0046]-[0049].

172. One of those additional possibilities expressly includes N=2 as claimed. Starting with the allocation units depicted in Figure 3C, Park discloses that resource allocation region A 401 shown in Figure 4 “can be represented as c(0) and c(1).” Park [0053]. In allocation mode “01,” this means that the resource allocation region A 401 can be expressed as the start allocation unit “c(0)” and the number of allocation units “2.” Park expressly confirms this understanding. Park [0053] (describing the same example as an example of a “continuous resource allocation region” that “can be simply represented by assigning a start allocation

unit index and a total number of the allocation units”); *see also* Park Translation⁵ at 026 (similar), 025 (explaining that the resource allocation region “can be displayed in a simple manner by designating the *first* allocation unit index and the total number of allocation units”) (emphasis added). Like the example in Figure 5B, this example also discloses a single-integer starting time-frequency coordinate through an index value of “zero” and N time-frequency resource units. This time, N=2, exactly as claimed.

173. This can be visualized by overlaying Figure 3C (showing one way to index the total resource) onto Figure 4 (showing various resource allocation regions).

⁵ As I have mentioned elsewhere, a POSA would have been aware of the disclosure in the original-language Park as part of the POSA’s background knowledge, and a POSA would have used that knowledge to confirm the POSA’s understanding of Park.



174. The above figure also shows how a given allocation unit can be used to describe multiple resource allocation regions. As just described, resource allocation region A can be described in terms of the start allocation unit index of “0” and the number of units “2.” Using the same allocation resource units, allocation region “C” can be described is the start allocation unit “8” and the total number of resource allocation units “1.” Park explains exactly this. Park [0052]-[0053].

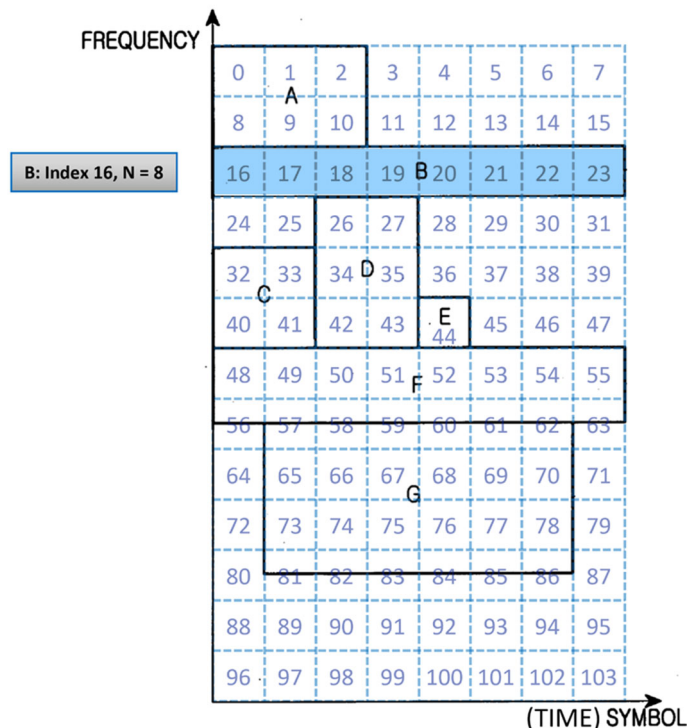
175. As shown in the overlaid image above, resource allocation region A does not perfectly align with the boundaries of two allocation resource units “0” and “1.” I understand from counsel that patent figures are not necessarily drawn to scale, which is one explanation. However, it is also possible for a resource

allocation region to not need the entirety of the second resource allocation unit. A transmission does not need to use the whole portion of an allocated resource. To not waste the extra resource, a POSA would have understood that the base station could transmit additional data or correction bits in that space. For example, generally including forward error correction (FEC) would reduce efficiency by providing redundant data in an attempt to preempt any transmission errors. *E.g.*, Eklund at 48. However, if there is already-allocated space, the inclusion of FEC would allow the system to quickly correct transmission errors without reducing the efficiency. Eklund at 48.

176. The same exercise can be performed for the resource allocation units shown in Figure 5A, 5C, and 5D and Park provides a range of examples. I note, however, that for one such example, there appears to be a typographical error. Park states that, using the allocation units depicted in Figure 5B, resource allocation region B 402 “can be represented as b(0).” Park [0052]. Resource allocation unit “0” in Figure 5B, however, is at the very top of the total time-frequency resource. In contrast, resource allocation region B 402 in Figure 4 lower on the frequency access. Based on a comparison of Figure 4 and Figure 5B, the correct resource allocation unit to describe resource allocation region B 402 would be “2.”

177. While Park does not provide this specific example, Park also discloses a segment with a starting time-frequency coordinate and N=8 time-frequency

resource units. Overlaying Figure 3D (providing another example of indexed allocation units) with Figure 4 (showing the resource allocation regions) appears as follows:



178. Park explains that the allocation mode “01,” where the resource allocation region can be expressed as a “start allocation unit index” (starting time-frequency coordinate) and the “total number” of allocation units can be used for any resource allocation region. Park [0066], [0070].

179. Resource allocation region B can therefore be described in terms of a start allocation unit “16” and N=8 allocation units, which would describe the space covered by allocation units d(16) through d(23), which, in turn, corresponds to resource allocation region B.

180. The possibilities for combinations of a starting time-frequency coordinate and N are practically endless. As Park explains, the total resource (AMC area) can be divided into allocation units of “various sizes and shapes” and the resource allocation regions can vary in size and shape, as well as location in the total resource (AMC area). Park [0046], [0081]-[0083]. “N” can therefore be any number of allocation units needed for a particular allocation region, expressed as a positive integer value from 1 up through the number needed to express the entire resource. Park [0070].

181. Park also teaches it can use the same or different allocation unit types (AUT, which refers to the indexing schemes in Figures 3A to 3D) for a given mobile device, which will be indicated in Park’s modified DL-MAP IE. Park also teaches that it can use the same allocation mode or modes (AM, which refers to the allocation modes in Figures 5A through 5C) for a given mobile device, which is also indicated in Park’s modified DL-MAP IE. Park [0055]-[0064]. As Figure 218 in 802.16-2004 shows in a visual representation, Park’s modified DL-MAP IE will precede, apply to, and allocate resource for each frame of data transmission, which includes the AMC zone (Park’s total resource region). By extension, the DL-MAP IE loops through all of given user’s resource allocation region (the claimed segments).

182. This is consistent with (and a better disclosure of) how the '450 patent contemplates using its “starting time-frequency coordinate” and “N time-frequency resource units.” While not claimed, the '450 patent contemplates N=1, N=2, and other values. '450 patent at 6:35-45, Table 1. And, the '450 patent specifically acknowledges that N is “simply an integer multiple of the basic unit,” without limiting the range of that integer. '450 patent at 6:52-53.

6. Element 2(c) – units contain frequency subcarriers in a group of OFDM symbols

183. Park and 802.16-2004 also disclose that the “units contain frequency subcarriers in a group of OFDM symbols.”

184. As described above, Park teaches that its allocation units can be “variously defined” to be any suitable size and shape, including being defined according to time and frequency. Park [0044]-[0047]. From that alone, a POSA would understand that Park’s contemplates allocation units with multiple frequency subcarriers in a group of OFDM symbols, as claimed.

185. Additionally, Park and 802.16-2004 disclose allocation units that are at least as large as the standard-defined basic allocation unit for AMC. 802.16-2004 defines the basic allocation unit for AMC as “nine contiguous subcarriers within an OFDMA symbol.” 802.16-2004 at 574. Park’s allocation units, therefore, must be at least nine frequency subcarriers in one OFDM symbol.

186. Both Park and 802.16-2004 refer to this 9 subcarrier x 1 OFDM symbol unit as a “bin.” Park uses the same definition of a “bin” as 802.16-2004: “9 sub-carriers sequentially provided in one OFDMA symbol.” Park [0009]; 802.16-2004 at 574.

187. Park also teaches using larger allocation units. For example, Park shows a resource indexed using one type of exemplary resource allocation unit in Figure 3D. As described above, at its smallest, the resource allocation units in Figure 3D cannot be smaller than the basic allocation unit for AMC (one bin). Looking at Figure 3, it is readily apparent that the allocation units in, for example, Figures 3A and 3C are larger than those shown in Figure 3D; by extension, the allocation units in Figures 3A and 3C must, at the very least, be larger than the basic allocation unit defined in 802.16-2004. The text of Park confirms, describing the resource allocation units in Figure 3A as “one Band” and the resource allocation units in Figure 3C as “four sub-channels,” both of which are larger than the “one sub-channel” resource allocation unit in Figure 3D. Park [0049]; 802.16-2004 at 574 (“[a] group of four rows of bins is called a band” and a subchannel is “a group of six contiguous bins in a band”). This is particularly evident for the time dimension where Figure 3D shows eight allocation units along the time dimension for the entire resource while Figure 3A shows one and Figure 3C shows four. The resource allocation units shown in Figure 3A and 3C therefore must, at

a minimum, span more than one OFDM symbol with each OFDM symbol having at least nine frequency subcarriers within it, as set by the standard. 802.16-2004 at 574.⁶

188. Park further teaches that even the smaller resource allocation units shown in Figure 3D can be larger than the standard-defined basic allocation unit. Park specifies that the resource allocation unit in Figure 3D is “one sub-channel.” Park [0049]. A “sub-channel,” as described in 802.16-2004, has both a time and frequency dimension. In AMC, a sub-channel can be 1 bin by 6 symbols or 2 bins by 3 symbols. 802.16-2004 at 517.

189. Combining this information and running the numbers, this means that, in Park (which, as described above relates to AMC), the resource allocation unit depicted in Figure 3D can be either 9 subcarriers over 6 OFDM symbols (1 bin of

⁶ Park describes the resource allocation units depicted in Figure 3B as “one sub-carrier.” Park [0049]. As described above, the basic allocation unit in AMC has nine subcarriers. Park [0009]; 802.16-2004 at 574. A POSA would have understood that a single subcarrier resource allocation unit is too small for an AMC allocation unit. If Figure 3B depicted resource allocation units of one bin, then the bin would cover the width (in time) of the resource. Park Fig. 3B.

9 subcarriers in 6 symbols) or 18 subcarriers over three OFDM symbols (2 bins of 9 subcarriers in 3 symbols).

190. The same analysis can be performed for the allocation units depicted in Park's Figure 3C that have "four sub-channels." Park [0049]. The "four sub-channels" can be thought of as oriented in a 2x2 square, so a four sub-channel allocation unit is two times larger in the time dimension and two times larger in the frequency dimension. This corresponds to 18 subcarriers in 12 symbols (2 times 1 bin of 9 subcarriers in one symbol x 2 times 6 symbols) or 36 subcarriers in 6 symbols (2 times 2 bins of 9 subcarriers in one symbol x 2 times 3 symbols).

191. Park leaves the ultimate determination of the size and shape of the allocation unit to a POSA and a POSA would want to maximize the size of the allocation to increase throughput, especially for data-intensive transmissions, such as video. *E.g.*, Eklund at 11-12 (describing throughput as "critical"); Park [0047] (explaining that the resource allocation unit can be "variously defined), [0048] (listing multiple options for both time and frequency intervals); Park Translation (providing the same examples for time and frequency intervals, and adding "etc." to further indicate that the list is exemplary).⁷

⁷ As I have mentioned elsewhere, a POSA would have been aware of the disclosure in the original-language Park as part of the POSA's background knowledge, and a

7. Element 3: recover the information using the starting time

192. Park and 802.16-2004 teach that the mobile station is configured to “recover the information using the starting time-frequency coordinate and N in conjunction with the identifier.”

193. Both Park and 802.16-2004 relate to a mobile communication system where a base station transmits information to a specific subscriber station (mobile device). Park [0005]-[0006]; 802.16-2004 at 316.

194. To transmit the information, the base station encodes the message for the mobile station to later decode. A given mobile device will have at least one receiver that will decode the transmission for use by the device. Eklund at 287.

195. The DL-MAP contains the information needed for the mobile device to decode the data transmission by (as described in more detail above) indicating resource allocation information and defining access to the downlink information. Park [0013]; 802.16-2004 at 82, 152, 316; Eklund (Ex. 1025) at 78, 144.

196. Park’s DL-MAP, in turn, incorporates “the starting time-frequency coordinate, N, and the identifier,” all of which are described above in greater detail. Specifically, Park’s DL-MAP used for recovering the information includes a “Start

POSA would have used that knowledge to confirm the POSA’s understanding of Park.

allocation unit index” (the claimed “starting time-frequency coordinate), “Number of allocation units” (the claimed “N time-frequency resource units”), and “RCID_ID” (the claimed “identifier”). Because these aspects are included in the DL-MAP which operates to decode and recover the information, Park discloses using these aspects to recover the information, as claimed.

C. Dependent Claim 11

197. Claim 11 depends from claim 1. Because claim 11 recites “The mobile device of claim 7” to start, Park and 802.16-2004 disclose this limitation for the reasons described above.

198. Claim 11 additionally recites “where in modular coding is applied to the time frequency resource units in the segment of the time-frequency resource.”

199. I understand from counsel that the parties have agreed that “wherein modular coding is applied’ is to be construed as “wherein a modular coding scheme is applied” and I have applied that construction in the foregoing analysis.

200. Both Park and 802.16-2004 disclose the same well-known modular coding schemes set forth in the ’450 patent. The ’450 patent identifies 16QAM and QPSK as modulation coding schemes. ’450 patent at 7:7-20, Table 1.

201. 802.16-2004 expressly discloses these same modulation and coding schemes and indicates they are supported by the standard. 802.16-2004 at 605 (listing QPSK, 16QAM, and others).

202. While Park does not specifically identify any particular modulation and coding schemes in its disclosures, Park teaches that “the combination of the ‘Nep code’ and ‘Nsch code’ indicates the number of allocated sub-channels and coding and modulation schemes for the downlink (DL) burst” in both the unmodified 802.16-2004 DL-MAP and Park’s modified DL-MAP. Park [0015] (describing Table 1, which is Table 97 in 802.16-2004), [0057] (describing Park’s modified DL-MAP).

203. 802.16-2004 explains how the “Nep code” and “Nsch code” relate to specific modulation and coding schemes. 802.16-2004 at 605.

204. After noting that the “supportable modulating schemes are QPSK, 16-QAM, and 64-QAM,” 802.16-2004 explains that a “modulation order is determined by the value of MPR.” 802.16-2004 at 605. MPR is calculated as $MPR = \frac{N_{EP}}{48N_{SCH}}$. 802.16-2004 at 605. Based on this calculation, the modulation and coding scheme is determined. 802.16-2005 at 605. If MPR is between 0 and 1.5, then QPSK is used; if MPR is between 1.5 and 3, then 16QAM is used. 802.16-2004 at 605. Therefore, a POSA would understand Park’s disclosures of “Nep code” and “Nsch code” in the DL-MAP IE to be referring to the same modulation and coding schemes identified in the ’450 patent, namely, QPSK and 16QAM.

205. For the avoidance of confusion, I note that, in this description of the DL-MAP, 802.16-2004 references that “UL MAP,” which appears to be a typographical error. Not only is the relevant discussion about the downlink (“DL traffic burst”), Table 97 of 802.16-2004 indicates that N_{EP} and N_{SCH} are included in the DL-MAP IE. This understanding is confirmed by the corrigendum included in the publication of 802.16e, which revises “UL MAP” to read “HARQ MAP.” 802.16e-2005 (Ex. 1014) at 624.

206. Park and 802.16-2004 also disclose that these modulation and coding schemes are applied to the time-frequency resource units. In both Park and 802.16-2004, information regarding the modulation and coding schemes is included in the DL-MAP IE. Park Table 1, Table 2; 802.16-2004 at Table 97. As described above, Park teaches that DL-MAP IE is used to allocate resources resource information in the AMC area. Park [0013]. Park also teaches that the “Nep code” and “Nsch code” included in the DL-MAP IE indicates the coding and modulation scheme for the DL burst, which, as described above, is contained in the AMC area. Park [0057].

207. As explained above, the AMC area is the total resource region in Park that is indexed and within which there are resource allocation regions. Therefore, when Park and 802.16-2004 apply the modulation and coding scheme to an AMC area, a POSA would understand that the modulation and coding scheme is being

applied to the resource allocation regions (claimed segments) and the allocation units (claimed time-frequency resource units).

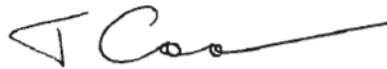
208. Another way to look at it is that, as described above, the DL-MAP IE disclosed in Park and 802.16-2004 contains an RCID, which identifies a mobile station. Park Table 1. Park, in turn, teaches that its invention is directed to allocating resource information “to each terminal” (mobile device) based on the disclosed “allocation unit information and an index value of a predetermined allocation unit.” *E.g.*, Park [0033]. The DL-MAP IE disclosed in Park therefore applies to Park’s resource allocation regions and resource allocation units, including any included modulation and coding scheme information.

209. 802.16-2004 also discloses using CRC (“Cyclic Redundancy Check”) to detect transmission errors during this same process. 802.16-2004 at 604 (explaining that CRC is used for error detection when H-ARQ is applied to a packet). The ’450 patent similarly recites using FEC (“Forward Error Correction”). ’450 Patent at 3:59-62, 6:31-34. FEC and CRC are both error detection and control techniques. Eklund at 48, 64 (“The FEC described in the PHY section earlier in this chapter may also be used as an error detection mechanism[.]”). In fact, FEC is the most common technique for error detection and correction. *Id.* at 48.

XII. Conclusion

All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true. Further, I am aware that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001. I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 28, 2023, in Fort Wayne, Indiana.

A handwritten signature in black ink, appearing to read 'T Cooklev', with a long horizontal line extending to the right.

Todor Cooklev