

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMERICAN HONDA MOTOR CO., INC.,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

Case IPR2023-00793
Patent 10,447,450

EXHIBIT 2001

DECLARATION OF WILLIAM P. ALBERTH, JR.

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I. INTRODUCTION

1. My name is William P. Alberth Jr. I am an expert in mobile telecommunications and wireless technology. As further detailed below and exhibited in my attached Curriculum Vitae, I have over 25 years of experience in the design, development, implementation, and manufacturing of mobile telephones, smartphones, and other electronic equipment in addition to being an inventor on over 100 patents, including those related to telecommunications and wireless communications.

2. I have been retained as an expert witness to provide my independent opinion in regard to the matters at issue in *inter partes* review of U.S. Patent No. 10,447,450 (“the ’450 patent”) in IPR2023-00793. I have been retained by Neo Wireless LLC (“Neo”), the Patent Owner in the above proceedings. The Petitioner is American Honda Motor Co. Inc. (“HONDA”). I was previously retained by Neo to opine on this same patent and same claims in IPR2021-01486, in which I understand the proposed grounds of review were not instituted for a trial because the tribunal determined that the record of that proceeding did not indicate even a reasonable likelihood that the challenger of the ’450 patent in that case could succeed at trial in proving unpatentability of any of the claims.

3. For my work on this case, I am being compensated for my time at my typical consulting rate of \$200 per hour. I am also being reimbursed for expenses

that I incur during the course of this work. My compensation does not depend on the substance of my opinions or the outcome of any issues in this case.

4. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to amend or supplement my opinions based on additional documents or evidence I am presented, including without limitation any arguments or expert declarations advanced by HONDA in this case.

II. QUALIFICATIONS

5. I believe that I am qualified to be an expert witness in this matter as I possess the requisite knowledge, skill, experience, training and education relating to the subject matter covered by the asserted patents.

6. In summary, I have over 25 years of experience in the design, development, implementation, and manufacturing of mobile telephones, smartphones, and other electronic equipment. The majority of my career was spent at Motorola where my final role was serving as the Chief Technology Officer for Motorola Mobile Devices. I held that position from 2007 until August 2012, and in that role, I led the development of differentiating technology that was integrated into Motorola's commercial mobile telephone products.

7. During the early stages of my career with Motorola (between 1987 and 2006, covering the Priority Date of the '450 patent), I was employed as an engineer, working on developing cutting-edge chipsets to enable cellular devices, and in the development of many products that changed the way people communicated, including the development of the Motorola MicroTAC, StarTAC and RAZR mobile telephones. I worked on or directed work on evaluating transmitter technologies and architectures to mitigate the effects of PAPR (Peak to Average Power Ratio) on the current drain of the devices. Some of the techniques evaluated include for example: pre-distortion; envelope following; EER (Envelope Elimination and Restoration); and adaptive biasing.

8. My educational background includes a B.S. in Electrical Engineering from the University of Illinois Urbana-Champaign (1985), and a M.S. in Electrical Engineering from Illinois Institute of Technology (1992).

9. I am inventor or co-inventor on over 100 patents issued or pending, including patents related to my work on transmitter architectures involved for wireless communications.

10. In forming my opinions here, I am relying on my education and experience, including my over 25 years of experience in a variety of technologies and industries related to various wireless communications systems.

11. Additional information concerning my background, qualifications, publications, conferences, honors, and awards are described in my Curriculum Vitae, a copy of which is attached with this Report as Appendix A.

III. LEGAL STANDARDS

12. I am not a lawyer, and I do not intend to offer any opinions as to the interpretation of the law. However, I have a general understanding of claim construction based on my experience with patents, my work as an expert in other cases, and my conversations with counsel. When considering the '450 patent and stating my opinions, I rely on the following legal standards as described to me by the attorneys for Neo.

13. I understand that a patent claim is unpatentable if the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the purported invention.

14. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the invention in view of the prior art and in light of the general knowledge in the art as a whole. I also understand that obviousness is ultimately a legal conclusion based on underlying facts of four general types, all of which must be considered: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences

between the claimed invention and the prior art; and (4) any objective indicia of non-obviousness, including any praise of the invention.

15. I also understand that obviousness may be established under certain circumstances by combining or modifying the teachings of the prior art. Specific teachings, suggestions, or motivations to combine any first prior art reference with a second prior art reference can be explicit or implicit, but must have existed before the date of purported invention. I understand that prior art references themselves may be one source of a specific teaching or suggestion to combine features of the prior art, but that such suggestions or motivations to combine art may come from the knowledge that a person of ordinary skill in the art would have had.

16. I understand that a reference may be relied upon for all that it teaches, including uses beyond its primary purpose, but also including teachings that lead away from the invention. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, although the mere disclosure of alternative designs does not teach away.

17. I further understand that whether there is a reasonable expectation of success in combining references in a particular way is also relevant to the analysis.

18. I understand that it is improper to use hindsight to combine references or elements of references to reconstruct the invention using the claims as a guide. My analysis of the prior art is made from the perspective of a person of ordinary skill in the art at the time of the invention.

19. I am not offering any legal opinions in this declaration nor am I qualified to do so. I only consider such legal standards in framing my opinions and conclusions as well as placing assertions made by Petitioner in the Petition into the proper context. Additionally, from a subject matter perspective, I understand that the petitioner always has the burden of persuasion regarding a challenge of patentability of an invention under an inter partes review.

20. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art, which I understand is sometimes referred to as an “ordinary artisan” or by the acronym “POSITA” as of the date of the invention, which I understand is here assumed to be the filing date (September 28, 2005) of US Provisional Application Serial No. 60/721,451, to which the ’405 claims the benefit of an earlier filing date. My opinion would not change if the date of invention were found to be the filing date of the earliest non-provisional application in the benefit chain (September 28, 2006). I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known

the relevant art at the time of the invention. By “relevant,” I mean relevant to the challenged claims of the ’450 patent.

IV. LEVEL OF ORDINARY SKILL IN THE ART

21. I understand that factual indicators of the level of ordinary skill in the art include the various prior art approaches employed, the types of problems encountered in the art, the rapidity with which innovations are made, the sophistication of the technology involved, and the educational background of those actively working in the field. I understand that, in assessing the level of skill of a person of ordinary skill in the art, one should consider the type of problems encountered in the art, the prior solutions to those problems found in the prior art references, the rapidity with which innovations are made, the sophistication of the technology, the level of education of active workers in the field, and my own experience working with those of skill in the art at the time of the invention.

22. In this case, Dr. Wilson has asserted in her declaration the following standard for a person of ordinary skill in the art as of the time of the ’450 patent:

In my opinion, a person of ordinary skill in the art (“POSITA”) in the context of the ’450 patent as of September 28, 2005 (the earliest priority date of the ’450 patent), would have a B.S. degree in electrical engineering, computer engineering, or computer science, or an equivalent field, as well as at least 3-5 years of academic or industry experience in mobile wireless communications, or comparable industry experience. A greater amount of education, i.e., a doctorate in electrical

engineering, computer engineering, computer science, or an equivalent field would also qualify as a POSITA for the '450 patent in lieu of a B.S. degree. Experience could take the place of some formal training, as domain knowledge may be learned on the job. This description is approximate, and a higher level of education or skill might make up for less experience and vice versa.

Ex. 1003 [Wilson Decl.] ¶ 52.

23. For the purposes of this declaration, I accept Dr. Wilson's proposed qualifications of a POSITA. I reserve the right to revisit the issue should the Petition be instituted. Based on my experience and qualifications, I am a person of ordinary skill in the art and was a person of ordinary skill in the art at the relevant date. The opinions I render in this declaration are from the perspective of POSITA.

V. PRIOR OPINIONS

24. In the IPR2021-01486 litigation I submitted a declaration concerning the '405 patent, which I incorporate into this declaration to ensure that it is part of the record in this proceeding. The following excerpts are from paragraphs 25-55 of my declaration from IPR2021-01486. The citations to the Petition and exhibits in this section are to those in IPR2021-01486.

A. The '450 Patent And 802.16 Standard

25. Under the 802.16 standard, four parameters are needed to allocate resources in the two independent dimensions of frequency and time. *See* Ex. 1001

[’450 Patent] 1:62-66; *see also* Ex. 1008 [IEEE802.16-2004] 557 (TABLE 275).

In the background of the ’450 patent they are referred to as the “start symbol offset,” “symbol length,” “start logical subchannel offset” and “number of allocated subchannels.” Ex. 1001 [’450 Patent] 1:62-66. The IEEE802.16-2004 standard refers to these same parameters as “OFDMA symbol offset,” “No. OFDMA Symbols,” Subchannel offset, and “No. Subchannels.” Ex. 1008 [IEEE802.16-2004] 557 (TABLE 275).

26. The inventors observed the “significant control overhead” needed to communicate these values from a base station to mobile stations. Ex. 1001 [’450 Patent] 1:51-52. Addressing these issues, they said that they conceived as an aspect of their invention “an alternative way of managing multiple packet streams” to “overcome the inefficiencies associated with maintaining” mappings under the IEEE 802.16 standard. *Id.*, 5:41-43.

27. Instead of spreading the various applications carried in packet streams throughout the available resource region, following the IEEE 802.16 standard, the inventors said they instead “group[ed] like applications together.” *Id.*, 5:43-53. The ’450 patent’s FIG. 6, reproduced here, illustrates this grouping approach:

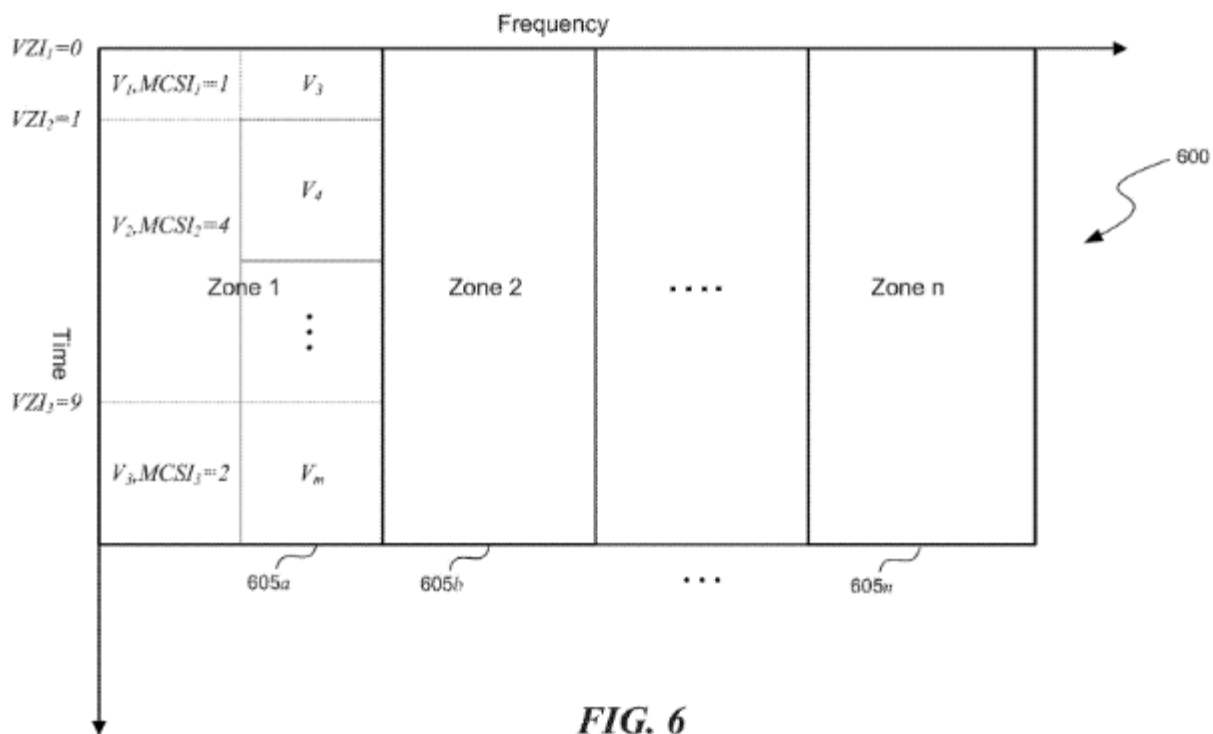


FIG. 6

28. The “zones” shown above are designated for particular applications. *Id.*, 2:48-49. In the example embodiment, Zone 1 (605a) is associated with voice applications and Zone 2 (605b) is associated with video applications. *Id.*, 5:46-49.

29. Grouping by common application allowed the inventors to establish common resource requirements among all users, which in turn allowed the inventors to map the time-frequency resource by one-dimensional “time-frequency resource units” designed to fit these common resource requirements. The ’450 patent specification refers to these time-frequency resource units as basic resource units. *See id.*, 6:49-50, 7:12-30.

30. As shown in FIG. 6 of the ’450 patent, Zone 1 is “further subdivided into time-frequency [resource] segments,” $V_1, V_2, V_3, V_4, \dots, V_m$, each

representing a packet stream associated with an application for Zone 1. *Id.*, 6:3-6, 6:10-11, 6:22-23. Each time-frequency resource segment can be expressed in terms of a number (N) of “basic resource unit[s],” each having a fixed number of symbols and subcarriers. *Id.*, 6:9-10, 6:49-50. In the example in the ’450 patent, the basic resource unit has 80 raw symbols in a certain number of subcarriers, which as discussed below, is selected specifically for VOIP applications. *Id.*, 6:9-10, TABLE 1.

31. TABLE 1 of the ’450 patent, reproduced below, provides a value (an “MCS index” or MCSI) that indicates how many basic resource units (“Units”) are in any given time-frequency resource segment as used in a VOIP application:

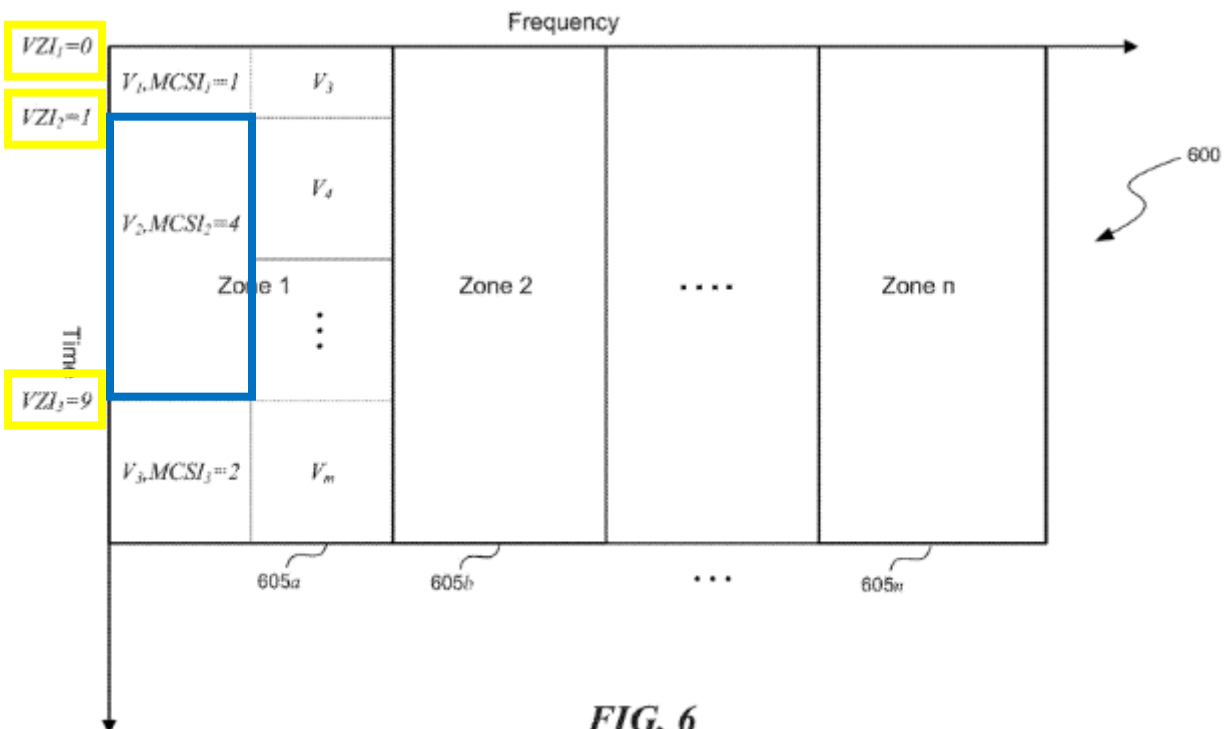
MCSI	Modulation	Coding rate	Information bits	Raw symbols	Units
1	16QAM	$\frac{1}{2}$	160	80	1
2	QPSK	$\frac{1}{2}$	160	160	2
3	QPSK	$\frac{1}{4}$	160	320	4
4	QPSK	$\frac{1}{6}$	160	640	8

Id., 6:56-58 (“For a known vocoder, MCSI ... implies the number of ... resource units required for a voice packet.”). FIG. 6, above, shows, for example, that time-frequency resource segment V_1 has an MCS index $MCSI_1$ of 1. If one follows the blue line for $MCSI_1$ over to Units in TABLE 1, one sees that this corresponds with one basic resource unit. As for time-frequency resource segment V_2 , it has an

MCS index $MCSI_2$ of 4, that corresponds with eight basic resource units, as shown by the orange line.

32. In this example embodiment, the number of Units $N=2, 4$, or 8 refers to a case where the packet stream corresponding to the time-frequency resource segment is transmitted using QPSK modulation using rate-1/2, 1/4, or 1/8 coding. *Id.*, 6:45-62.

33. Returning to the embodiment of FIG. 6, reproduced again below with color annotations added, the one-dimensional time-frequency starting coordinate (VZI_m), e.g., 0, 1, 9, etc., highlighted in yellow, defines where a packet stream's associated time-frequency resource segment (V_m) starts in a zone both in time *and* frequency. *Id.*, 7:10-27.



34. FIG. 6 does not show using a time coordinate and an independent frequency coordinate to specify V_2 , highlighted in blue. FIG. 6 shows, instead, that only one time-frequency coordinate, $VZI_2=1$, is needed to specify where V_2 starts in both time and frequency. That is consistent with the invention's objective of reducing control overhead.

35. As I noted above, TABLE 1, above, shows a specific manner to utilize the invention to make time-frequency resource units that support the VOIP requirements faced by each VOIP user. The time-frequency resource units are said to be designed to carry a single VOIP packet. *Id.*, 6:56-58; *see also id.*, 2:8-10 ("20 byte" payload times 8 bits per byte equals 160 information bits, exactly as stated in TABLE 1). Granularity in allocating resources at a smaller scale than a single VOIP packet is not needed in a VOIP application and providing more granularity would require additional overhead. This time-frequency resource unit is designed to fit the VOIP packets for voice applications while allowing a one-dimensional allocation that balances the precision required for the VOIP application with the minimum amount of overhead.

36. In summary, the '450 patent's inventors transform the two independent dimensions of time and frequency into one time-frequency dimension measured by a basic resource unit or time-frequency resource unit having a fixed number of symbols in a fixed number of subcarriers that fits the resource

requirements of a given application and thus achieve an advantageous reduction in the amount of data required to allocate resources. Ex. 1001 [’450 Patent] 7:28-30 (“Using basic resource units as the granularity of a location offset to the packet stream reduces the number of bits required to represent its location with[in] the zone 605a.”).

37. Given the identity (m) of the relevant packet stream (*id.*, 6:3-21), the packet stream can be described by **(1)** the value of its one-dimensional time-frequency starting coordinate (VZI_m), which defines where the packet stream’s associated time-frequency resource segment (V_m) starts in the zone both in time and frequency (*id.*, 7:10-27); and **(2)** the number of time-frequency basic resource units in the time-frequency resource segment (based on $MCSI_m$), which defines where V_m ends, again both in time and frequency (*id.*, 7:7-39). Using time-frequency resource units, “each ... containing a set of frequency subcarriers in a group of OFDM symbols,” to define a new dimension of “time-frequency,” one can specify a resource in two parameters: a starting time-frequency coordinate and the number of time-frequency resource units in a time-frequency resource segment, as claimed.

38. The “time-frequency resource unit,” recited in the claims was significant and innovative as it allowed for reduction of the overhead required to transmit and recover data in a multi-carrier packet communication system because,

using this basic resource unit, the resource space can be defined with two parameters instead of four. This “time frequency resource unit” is thus not an arbitrary combination of time and frequency units. Instead, it is a parameter designed according to the application requirements of the application that is being grouped. By intentionally foregoing the flexibility of irregular resource allocation at the lowest granularity level, which requires multidimensional allocation, the inventors instead created regularly shaped time-frequency resource units allocated at the application granularity level. These resource units used a single dimension to provide the control overhead reduction. Without enforcing similar resource requirements between users of the same application the regularity of the time-frequency resource unit would not have been possible.

B. Time-Frequency Resource Units

39. As discussed next, no “time-frequency” resource unit is shown to be taught or suggested by the combination of Kim and IEEE802.16-2004. Just as in the IEEE 802.16 standard distinguished in the background of the patent, these two references describe time units (symbols) and frequency units (subchannels), and suggest no “time-frequency” resource unit that transforms the time and frequency units into one combined dimension as disclosed and claimed by the ’450 patent. Because there is no time-frequency dimension taught in Kim or IEEE802.16-2004, the combination lacks both of these innovative parameters. Instead, Kim and

IEEE802.16-2004, both alone and in combination, use an independent time dimension and an independent frequency dimension and require four parameters to map a packet stream, just like the prior art distinguished in the Background of the '450 patent. These references did not even recognize that control message overhead was a problem that needed to be solved, so they did not propose a method to solve it.

40. All the independent claims recite “the segment comprising N time-frequency resource units within a time interval.” Dr. Ding asserts that a POSITA would have understood that “each resource unit [is] defined by a *single subchannel (in frequency) and a single slot (in time)*.” Ex. 1003 [Ding Decl.] ¶ 129 (emphasis added). Furthermore, he states, “Kim discloses allocating resources (the claimed ‘segment’) with an *integer number of subchannels per slot (the claimed ‘resource units’)*, such as 8 subchannels within slot (0) and 12 subchannels within slot (1).” *Id.* ¶ 132 (original emphasis removed and new emphasis added). He concludes: “[w]ith this type of allocation, Kim discloses examples in which each user is allocated a resource ‘segment’ including multiple (‘N’) resource units, such as 8 resources units and 12 resource units, *within a single time slot (the claimed ‘time interval’)*. Thus, a POSITA would have understood that, in the Kim-IEEE802.16-2004 network, allocates a resource

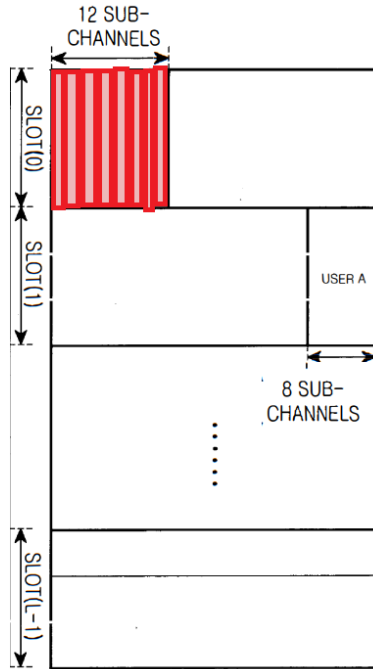
segment ‘comprising N time-frequency resource units within a time interval.’”

Id. ¶ 133 (original emphasis removed and new emphasis added).

41. In other words, he identifies an alleged frequency unit (“a single subchannel”). *Id.* ¶ 129. He identifies an alleged time unit (“a single slot (in time)”). *Id.* And he alleges that the identified frequency unit can be assigned a corresponding time unit (“an integer number of subchannels per slot”). *Id.* ¶ 132. But the analysis does not show any unifying time-frequency resource unit that transforms the dimensions of time and frequency into one dimension of time-frequency to achieve the reduction in control overhead that is central to the invention. As I explain next, this argument, while it purports to identify a “resource unit” defined as one subchannel in one time slot, it in reality defines the resource unit merely as one subchannel and fails to consider any time component. Put simply, there is no “time-frequency resource unit” in either Kim or IEEE802.16-2004, so the Petition must rely on the same independent time and frequency units utilized in the IEEE 802.16 standard upon which the invention is said to improve.

42. In essence, Dr. Ding’s analysis defines a “time-frequency resource unit[] within a time interval” as a subchannel in a single time slot in the same single time slot and, thus, equates time-frequency resource units with subchannels. As shown below in a side-by-side comparison of Kim’s FIG. 7 and the ’450

patent's FIG. 6, FIG. 6 has time-frequency resource units within a time interval that is tied to the number (N) of resource units, while Dr. Ding's theory has an arbitrary number of subchannels, with the time interval (a single time slot) having no relationship with the number of subchannels.



Kim, FIG. 7 (altered)

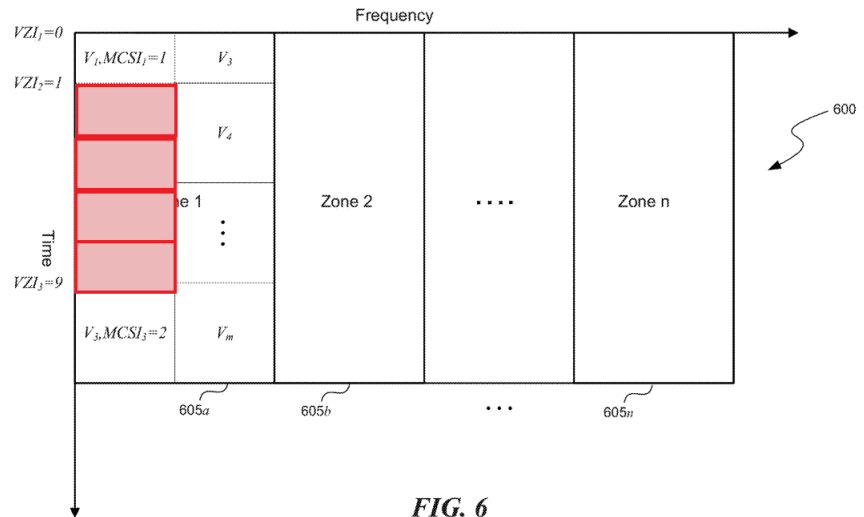


FIG. 6

'450 patent, FIG. 6 (altered)

43. As shown above, what Dr. Ding calls a “time-frequency resource unit” is, in reality, a *frequency* resource unit—a subchannel. This is incorrect because it interprets “time-frequency” such that the word “time” has no meaning. And this erroneous conclusion is not unexpected, because the time-frequency dimension that provides the reduction in control overhead is not taught in Kim or IEEE802.16-2004, for that matter.

44. Rather than describe the invention’s time-frequency resource units, Kim and IEEE802.16-2004 describe the same IEEE 802.16 prior art distinguished in the '450 patent’s Background section. Again, the patent explains that the existing IEEE 802.16 standard required *four* parameters in two independent

dimensions to allocate resources: a start symbol offset (8 bits) and a symbol length (7 bits) in the time dimension and a start logical subchannel offset (6 bits) and a number of allocated subchannels (6 bits) in the frequency dimension. Ex. 1001 [’450 Patent] 1:62-66. As I noted above, IEEE802.16-2004 shows those very four parameters in Table 275:

Table 275—OFDMA **DL-MAP** IE format

Syntax	Size	Notes
DL-MAP_IE() {		
DIUC	4 bits	
if (DIUC == 15) {		
Extended DIUC dependent IE	variable	See subclauses following 8.4.5.3.1
} else {		
if (INC_CID == 1) {		The DL-MAP starts with INC_CID = 0. INC_CID is toggled between 0 and 1 by the CID-SWITCH_IE() (8.4.5.3.7)
N_CID	8 bits	Number of CIDs assigned for this IE
for (n=0; n< N_CID; n++) {		
CID	16 bits	
}		
}		
OFDMA Symbol offset	8 bits	
Subchannel offset	6 bits	
Boosting	3 bits	000: normal (not boosted); 001: +6dB; 010: -6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB;
No. OFDMA Symbols	7 bits	
No. Subchannels	6 bits	
Repetition Coding Indication	2 bits	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11– Repetition coding of 6 used

Start symbol offset

Start logical channel offset

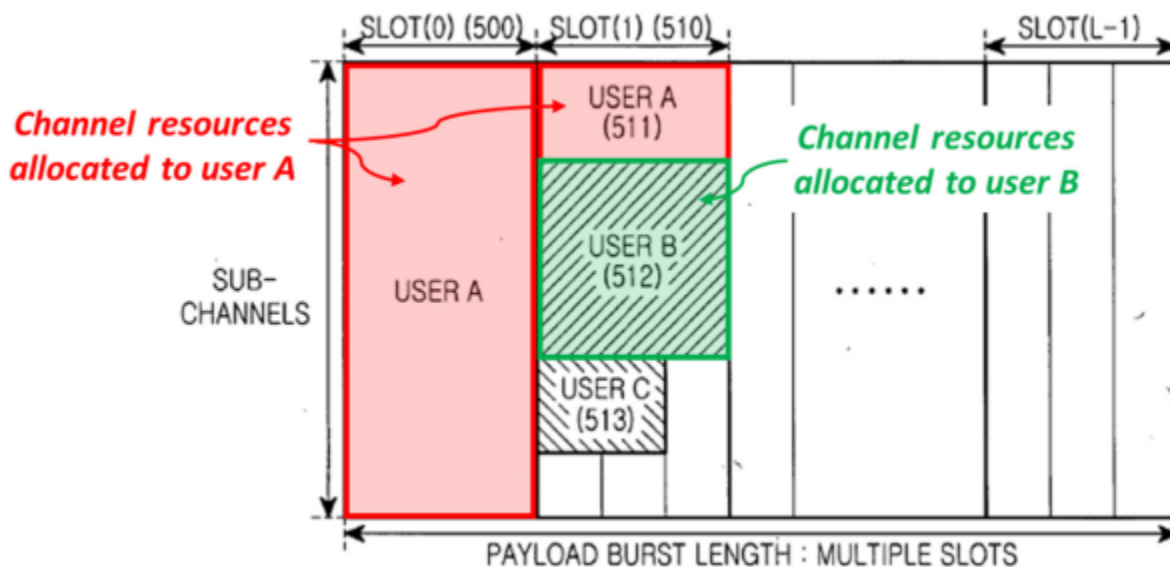
Symbol length

Number of allocated subchannels

45. Because IEEE802.16-2004 does not group users by application it must support flexible intermixing of applications where an individual user resource

requirement may vary widely. Accordingly, IEEE802.16 requires four parameters, two in time and two in frequency, to define a resource.

46. Kim does not disclose a different configuration. In fact, a POSITA would have understood that it teaches the same configuration as IEEE802.16-2004, because Kim's FIG. 5 shows a variety of irregularly shaped blocks that are positioned in time and frequency according to a user's exact needs which may vary greatly depending on the application being performed at that time. Kim needs to support applications with different resource granularity requirements, and thus different dimensions in time and frequency, as shown in Dr. Ding's annotations:



Ex. 1003 [Ding Decl.] ¶ 69. It can be seen that User C's block, which supports a HARQ application, has different resource granularity requirements than User B's block. See Ex. 1005 [Kim] ¶ 53.

47. The situation shown above illustrates the problem with IEEE 802.16 described in the Background of the '450 patent: “[d]ue to the fact that different applications have different resource requirements, the allocated resource region is *irregular from connection to connection*.” Ex. 1001 [’450 Patent] 1:66-2:2. As a result of that irregularity, in order to fully specify each User’s blocks Kim needs to define frequency *and* time in two independent dimensions, just like the IEEE 802.16 standard discussed in the ’450 patent Background and expressly improved upon by the claimed invention.

48. Thus, the combination of Kim and IEEE802.16 does not teach the use of time-frequency resource units and N from the ’450 patent. It uses the same two independent dimensions of time and frequency and known configuration of frequency units and independently mapped time units distinguished in the background of the ’450 patent. The combination of Kim and IEEE802.16-2004 do not provide a reduction in control overhead as advantageously taught in the ’450 patent.

C. Segment Of Time-Frequency Resource, The Segment Having A Starting Time-Frequency Coordinate

49. The independent claims also all require a “segment of a time-frequency resource, the segment having a starting time-frequency coordinate.” Dr. Ding opines that the OFDMA symbol specified by IEEE802.16-2004’s OFDMA symbol offset and the subchannel specified by IEEE802.16-2004’s “subchannel

offset” are collectively the claimed “time-frequency coordinate.” Ex. 1003 [Ding Decl.] ¶ 127. In other words, Dr. Ding is alleging that the time-frequency coordinate is a combination of two coordinates: a time coordinate and a frequency coordinate.

50. The ’450 patent does not support a construction of “time-frequency coordinate” that is a combination of a time coordinate and a frequency coordinate. The specification makes clear that one “index” specifies where a resource segment V_m starts in both time *and* frequency:

If a MCS from Table 1 is selected for each packet stream contained in a particular zone, the offset to a segment representing a particular packet stream may be easily calculated. *For example, an index $VZI_1, VZI_2, \dots VZI_m$ is shown at the origin of each segment that is contained in the zone 605a.* The index for any selected packet stream is defined as the sum of all basic resource units associated with each packet stream preceding the selected packet stream, with an optional adjustment depending on the location where the division of the time-frequency resource is started (typically no adjustment is required since the division starts at the origin of the zone). *For example, the location index for the first voice packet stream is $VZI_1=0$ since it starts at the origin of the zone 605a. The first packet stream has an MCS of 1, which implies that one basic resource unit is used. As a result, the index for the second voice packet stream is $VZI_2=1$. The second packet stream has an MCS of 4, which implies that eight basic resource units are used. As a result, the index for the third voice*

packet stream is $VZI_3=9$, arrived by summing the basic resource units used for the preceding first and second packet streams.

Ex. 1001 ['450 Patent] 7:7-27 (emphasis added).

51. The passage that Dr. Ding relies on to support his construction is actually a description of four parameters in the prior art being distinguished and does not mention any time-frequency coordinate. Ex. 1003 [Ding Decl.] ¶ 123 (citing Ex. 1001 ['450 Patent] 1:60-66).

52. In his “Overview of the '450 Patent” (starting at page 17), Dr. Ding also include a short discussion of the “starting time frequency coordinate,” citing the '450 patent at 5:57-63. Ex. 1003 [Ding Decl.] ¶ 57. That passage, however, describes an unclaimed embodiment and relates to the granularity of the time-frequency coordinate:

In some embodiments, the identification of the time-frequency segment associated with a particular packet stream can be indicated by the starting time-frequency coordinate and the ending time-frequency coordinate relative to the starting point of the zone. The granularity in the time coordinates can be one or multiple OFDM symbols, and that in the frequency coordinates can be one or multiple subcarriers.

Ex. 1001 ['450 Patent] 5:57-64. This passage does not define “time-frequency coordinate” to mean the combination of a time coordinate and a frequency coordinate, nor does Dr. Ding contend that it does. Instead, this passage is discussing granularity.

53. To understand why granularity does not redefine a one-dimensional coordinate as a combination of two coordinates, consider the torque, which like the claimed time-frequency resource unit, transforms two independent dimensions (force and distance) into one dimension. One can change the granularity of torque's force component and torque's distance component, to, for example, express torque in terms of ounce-inches instead of foot-pounds. That does not mean, however, that one specifies a torque by specifying a force and an independent distance. In a similar way, the granularity of the time-frequency coordinate can be specified in different ways, e.g., by reducing the number of subchannels in a time-frequency so that it is more granular in frequency and less granular in time, but this does not mean one may specify the claimed time-frequency coordinate by specifying a time coordinate and an independent frequency coordinate.

54. At any rate, as I noted above, this embodiment is unclaimed. It is clear that this embodiment is not claimed because the time-frequency segment is specified by a starting time-frequency coordinate and an ending time-frequency coordinate rather than the "starting time-frequency coordinate" and "N time-frequency resource units." Thus, unlike the claims, it uses two coordinates to map the packet streams rather than a starting coordinate and the number of time-frequency resource units. This passage at 5:57-63 of the '450 patent teaches that

the time-frequency coordinates used in this embodiment to specify the beginning and ending of the resource unit can be specified based on changing the number of OFDM symbols in the time dimension or the number of subchannels in the frequency dimension. It does not, however, teach that the time coordinate and frequency coordinate can be independently specified. Regardless of what is taught regarding this embodiment, the claimed embodiment recites a time-frequency coordinate which requires that time and frequency be specified together.

55. Unlike the claimed invention, the combination of Kim and IEEE802.16-2004 does not teach a way to reduce the number of bits necessary to map a packet stream, which further confirms that the combination does not teach using a time-frequency coordinate to perform the mapping.

VI. OPINIONS WITH RESPECT TO ISSUES IN THIS PROCEEDING

A. The Non-Institution Of IPR2021-01486.

56. I understand that the Board decided not to institute review of the '450 patent based on Dell's petition in IPR2021-01486. IPR2021-01486 Paper 10 ("01486-DDI"). I have reviewed that decision and note that the Board panel found that "the asserted combination fails to teach or suggest the recited 'segment of time-frequency resource . . . having a starting time-frequency coordinate and . . . comprising N time-frequency resource units.'" *Id.*, 26. It also stated that, "we find that such contentions are premised on Petitioner and its declarant's conclusory

conflation of ... separate starting time and frequency coordinates as the recited singular “starting time-frequency coordinate.” -01486-DDI, 27.

B. The Claimed “Starting Time-Frequency Coordinate.”

1. Using A One-Dimensional “Starting Time-Frequency Coordinate” Differs From Using A Separate Starting Time Coordinate And A Starting Frequency Coordinate.

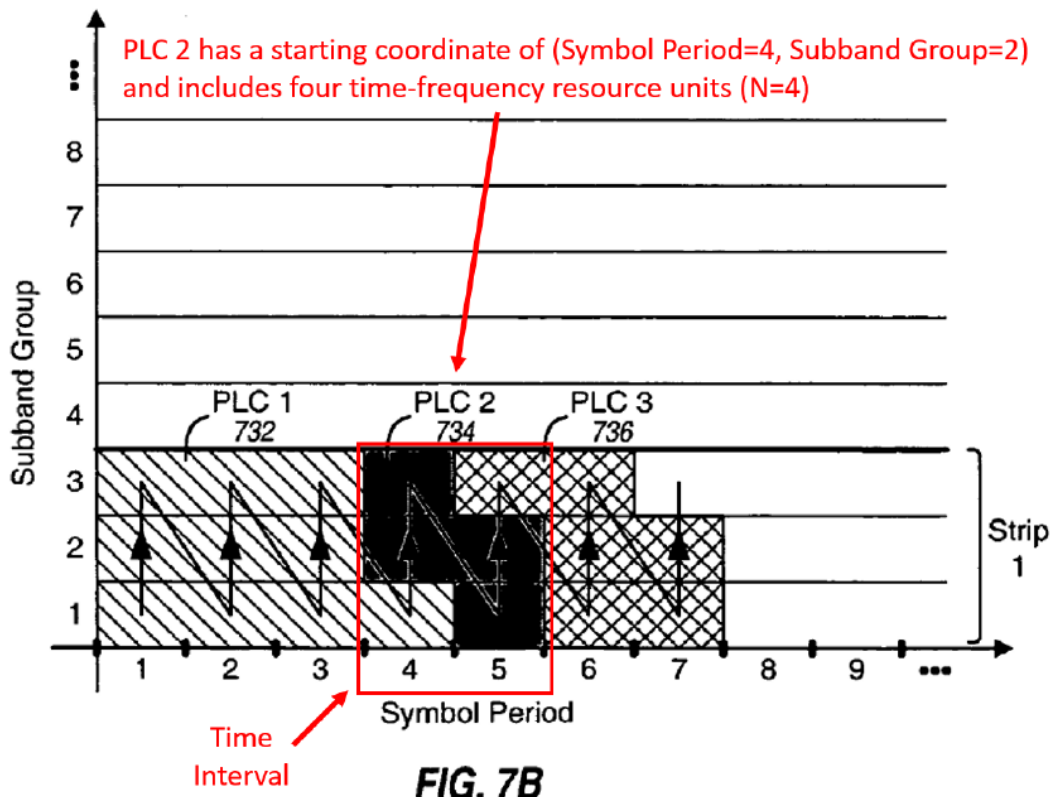
57. The '450 describes the prior art resource allocation as being specified with the start symbol offset, symbol length, start logical subchannel offset, and number of allocated subchannels. Ex. 1001 ['450 Patent] 1:62-66. Since the “start symbol offset” specified the starting location in the time domain, it defined a starting time coordinate. Similarly, since the “start logical subchannel offset” specified the starting location in the frequency domain it defined the starting frequency coordinate. By contrast, as I explained above, the '450 patent combines these two separate parameters into a single “starting time-frequency coordinate.” *See id.*, 7:10-27, FIG. 6. For example, FIG 6. uses a “starting time-frequency coordinate” $VZI2=1$ to specify where V2 starts in both time and frequency. *Id.*, FIG. 6. This one “starting time-frequency coordinate” combines time and frequency into a single dimension. A POSITA would have understood the claimed “starting time-frequency coordinate” to be different from and exclude the collective labeling of a starting time coordinate and a separately described starting frequency coordinate.

2. Vijayan089

58. Vijayan089 states that “the start of the segment (which may be given by the starting subband **and** symbol period).” Ex. 1005 [Vijayan089] ¶ 74.

Vijayan089’s “starting subband” describes the location of the start of the segment in the frequency domain. Thus, it is a starting frequency coordinate. Similarly, the starting “symbol period” describes where the segment begins in the time domain. It is thus a starting time coordinate. It is very similar to the 802.16 reference in the ’450 patent’s background. Both have a starting time coordinate and a separate starting frequency coordinate. The fact that Vijayan089 refers to the “starting subband and symbol period” together as the “start of the segment” does not change the fact that they are two separate parameters with one only in the time domain and the other only in the frequency domain.

59. I have excerpted below Vijayan089’s Figure 7B as annotated by Dr. Wilson in ¶ 149 of her declaration:



Vijayan089 describes segment 734 in Figure 7B, saying that “PLC 2 is assigned a segment 734 containing 4 slots from subband group 2 in symbol period 4 through subband group 2 in symbol period 5.”. Ex. 1005 [Vijayan089] ¶ 73. Here, Vijayan089 is specifying symbol period 4 as the starting time coordinate since that is the location in the time dimension of the first slot in the segment. Similarly, Vijayan089 specifies subband group 2 as the starting frequency coordinate since that is where segment 734 starts in the frequency dimension. This is indeed how Dr. Wilson’s annotation to Figure 7B, which states, “PLC 2 has a starting coordinate of (Symbol Period=4, Subband Group=2)”. Ex. 1003 [Wilson Decl.] ¶ 149. By using two separate parameters, one for the symbol period and another for

the subband group, Dr. Wilson is, in effect, stating that Vijayan089 discloses uses both a separate starting time coordinate and starting frequency coordinate.

3. Vijayan475

60. Vijayan475 describes several techniques for assigning its slots to a given MLC (Multiplexed Logical Channel – a data channel). *See e.g.*, Ex. 1006 [Vijayan475] ¶ 42 (“The parameters used to describe the slots assigned to each active MLC are dependent on the scheme used to assign the slots.”). In Vijayan475’s rectangular pattern, its “slot symbol period” is a starting time coordinate and its “slot index” is a separate starting frequency coordinate. *See* Ex. 1006 [Vijayan475] ¶ 42. This is much like the background art discussed in the ’450 patent where the “start symbol offset” was the starting time coordinate and the “start logical subchannel offset” was the starting frequency coordinate.

61. Vijayan475’s Figure 4 and accompanying description illustrate a zigzag pattern of frequency slots over symbol periods of time that is assigned to a MLC.

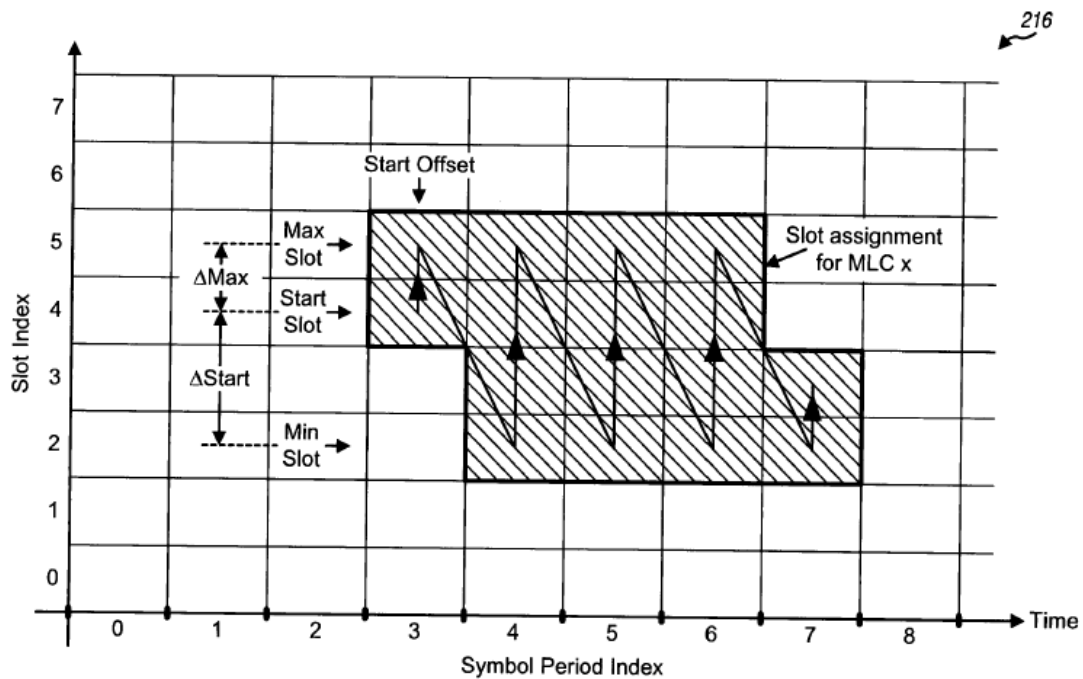


FIG. 4

Setting the stage, Figure 4 illustrates that the frequency domain that has been divided into eight units, each with a “Slot Index” starting at 0 and ending at 7. Ex. 1006 [Vijayan475] FIG. 4. The time domain has been divided up into nine units with a “Symbol Period Index” starting at 0 and ending in 8. *Id.* In the zigzag pattern the “symbol period index (Start Offset)” indicates the symbol period in which the MLC should start. *See id.*, ¶ 40. Thus it is a starting time coordinate. The “start slot index (Start Slot)” is a different parameter that indicates the slot index in which the MLC should start. *See id.* Thus it is a separate starting frequency coordinate. Vijayan475 also teaches two other parameters, Max Slot and Min Slot, that together determine the shape of the zigzag. *See id.*

62. Next, Vijayan475 introduces Slot Info. Ex. 1006 [Vijayan475] ¶ 45 (“The Slot Info field contains slot information, which conveys all parameters used to describe the assigned slots (e.g., the Min Slot, Start Slot, and Max Slot”). Its Table 1 has the following entries: “Start Offset | Indicate the starting symbol period index for the slots assigned to the MLC; Slot Info | Contain parameters describing the slots assigned to the MLC.” *Id.*, Table 1. As discussed above, Vijayan475 teaches that Start Slot defines starting slot in the frequency domain and thus is a starting frequency coordinate. Since the Slot Info includes the Start Slot, which is a starting frequency coordinate, among its parameters a POSITA would know that Slot Info is also a starting frequency coordinate. The fact that Slot Info also contains additional information (Min Slot and Max Slot) describing the shape of the zigzag does not negate the fact that it is a starting frequency coordinate. This starting frequency coordinate is separate and different from the starting time coordinate, which is the Start Offset. To be clear, the start offset is not part of the Slot Info. Vijayan475’s ‘Start Offset’ is consistently used to describe the start of the MLC in the time dimension, making it the starting time coordinate.

63. Vijayan475 also uses encoding to “reduce the number of bits needed to convey this information.” Ex. 1006 [Vijayan475] ¶ 46. This is most likely done because the zigzag shape requires more bits to describe its shape than the standard

rectangular shape. For example, Vijayan475's Figure 4 shows frame 216 having eight slots in the frequency domain, which would need three bits to describe using the prior art 802.16 standard described in the '450 patent. By contrast Vijayan475's system uses nine bits without encoding and seven bits with encoding. *Id.*, ¶ 49.

64. As discussed above, Vijayan475 describes the starting location and the shape of its zigzag pattern in Figure 4 using four parameters: the Start Slot, Start Offset, Max Slot, and Min Slot where Start Offset is the starting time coordinate and Start Slot is the starting frequency coordinate. *See* Ex. 1006 [Vijayan475] ¶¶ 40, 45. However, Vijayan475 also proposes using encoding to reduce the number of bits used to convey this information. *Id.*, ¶ 46. Vijayan475 never describes changing anything about the Start Offset, which it continues to use as the starting time coordinate. *See id.*, ¶¶ 46-54, 56, 58. It also continues to use the Min Slot. *Id.*, ¶ 48. But instead of directly using the Start Offset, Max Slot it introduces two parameters (Δ_{start} and Δ_{max}) that, along with Min Slot, can be used to calculate the Start Offset and Max Slot. *Id.*, ¶ 47. It gives the following formulas for calculating Δ_{start} and Δ_{max} :

$$\Delta_{\text{start}} = \text{Start Slot} - \text{Min Slot} \quad \text{Eq (2)}$$

$$\Delta_{\text{max}} = \text{Max Slot} - \text{Start Slot} \quad \text{Eq (3)}$$

Id., ¶ 47. Of course, these same formulas can be used to derive the Start Slot and Max Slot from Δ_{start} and Δ_{max} . Rearranging EQ(2), it is simple to show that:

$$\text{Start Slot} = \Delta_{\text{start}} + \text{Min Slot}$$

$$\text{Max Slot} = \text{Start Slot} + \Delta_{\text{max}}$$

65. Simply transmitting Δ_{start} and Δ_{max} instead of Start Slot and Max Slot would not necessarily result in any savings in overhead. The proposed reduction in overhead comes because Δ_{start} and Δ_{max} , along with Min Slot are tabulated alongside “Slot Info Code” in a table. *See* Ex. 1006 [Vijayan475] Table 2. Instead of directly sending Min Slot, Δ_{start} , and Δ_{max} Vijayan475’s second embodiment sends one of the Slot Info Codes – each of which provides a unique combination of Min Slot, Δ_{start} , and Δ_{max} . *Id.*, ¶ 49, Table 2. The Slot Info code requires only 7 bits whereas separately sending Min Slot, Start Slot, and Max Slot would require 9 bits. *Id.* As discussed earlier, this is still more than the 3 bits necessary to convey the starting frequency coordinate if the 802.16 scheme described in the ’450 background were used to describe the eight available slot indices. Regardless, the Slot Info Code, by encoding values for Min Slot and Δ_{start} , still conveys Start Slot. The Slot Info Code thus provides the starting location for the MLC in the frequency dimension and is itself a starting frequency coordinate.

C. The Claimed “Time-Frequency Resource Unit.”

1. “Time-Frequency Resource Unit” Not Limited To Grouped Applications.

66. I note that while my discussion above in ¶¶ 27-31, 35, and 38 reference an embodiment wherein the inventors grouped resources by common application type, as shown in Figure 6 of the patent, the invention is not limited to that form of grouping. The inventors expressly indicated that resource zones “designated for particular applications” are merely present “[i]n some embodiments,” *id.* at 2:47, and that packet streams may also be classified, for example, “based on application type, quality of service (QoS) requirement, or other properties.” *Id.* at 8:55-57. Thus, my discussion above, while illustrative of the concept that allowed the inventors to reduce control overhead, should not be read as an indication that a time-frequency resource unit is limited to a particular type of grouping. Indeed, a POSITA would understand that other forms of grouping would still allow for the reduction of control overhead envisioned by the inventors.

2. The “Time-Frequency Resource Unit” Spans “A Group Of OFDM Symbols,” Which Allows For A Reduction In Control Overhead.

67. The ‘450 patents’ claims require “N time-frequency resource units within a time interval, each unit containing a set of frequency subcarriers in a group of OFDM symbols.” Ex. 1001 [‘450 Patent] cls. 1, 7, 13.

68. Requiring that the basic resource unit (the claimed “time-frequency resource unit”) contain multiple OFDM symbols provides further savings in overhead. This is because when each unit is multiple symbols long, a given zone is divided up into fewer units, which means VZI (the “starting time-frequency coordinate” of the claims) can be sent with less bits. The ’450 specification gives an example where a zone is divided into 512 units (the “time-frequency resource units” of the claims). Ex. 1001 [’450 Patent] 7:30-33. This requires a maximum of 9 bits to address each possible starting location since $2^9=512$. *Id.*, 7:34-39. Thus, the “starting time-frequency coordinate” is only nine bits long. Recall that each of these units is composed of 80 raw symbols and thus, the zone has up to 40,960 ($512 * 80$) addressable locations. If the units were only one OFDM symbol long (such as in the Vijayan089 and Vijayan475 references) the VZI would need to address each of these potential 40,960 locations. This would require up to 16 bits. This savings in overhead comes at the cost of flexibility. Sending a packet stream (the claimed “segment”) that is not a multiple of the unit size (80 in the specification’s example) would result in wasted bandwidth between the end of that packet stream and the start of the next packet stream. In this example, the inventors were willing to accept this tradeoff of reduced flexibility in exchange for lower overhead because they designed this zone for voice packet streams that all require at least 80 raw symbols. *See id.*, 6:32-64.

3. Vijayan089

69. Vijayan089's symbol period is simply a measure of time, as indicated by the fact that it is described as the unit in time axis. This is illustrated most clearly in Vijayan089's Figure 4.

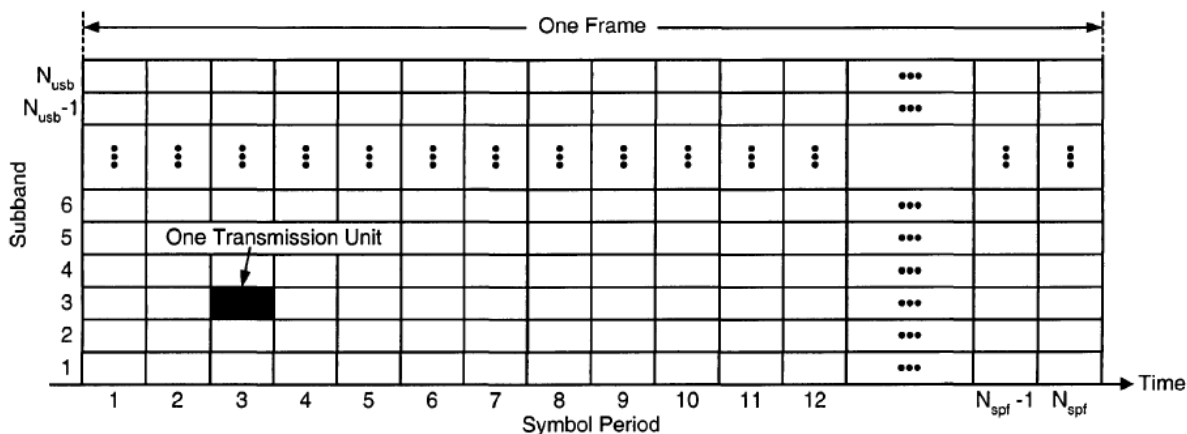


FIG. 4

Ex. 1005 [Vijayan089] Fig. 4. The number of the claimed “OFDM symbols” contained in a unit, such as shown in Figures 4 or 7B, can be measured using the ‘Symbol Period’ on the horizontal axis.

70. Vijayan089 states: “With OFDM, one modulation symbol may be sent on each subband in each symbol period, i.e., each transmission unit.” Ex. 1005 [Vijayan089] ¶ 47. These modulation symbols can be used to transmit data, a pilot signal or no signal at all if the modulation symbol is used as a guard. *See id.* (“As used herein, a “data symbol” is a modulation symbol for data, a “pilot symbol” is a modulation symbol for pilot, and a “guard symbol” is a signal value of zero.”).

There can be multiple modulation symbols in a single symbol period. *See id.*; *see also id.*, ¶ 59 (“A slot corresponds to one group of (e.g., 500) data subbands or, equivalently, one group of modulation symbols in one symbol period.”).

71. Dr. Wilson includes several times in her declaration annotated versions of Vijayan089’s Figure 7. *See e.g.*, Ex. 1003 [Wilson Decl.] ¶¶ 144, 149, 177; *see also* Pet., 46. Figure 7B of Dr. Wilson’s annotation to this figure correctly states that “PLC 2 ... includes four time-frequency resource units ($N=4$)¹. Ex. 1003 [Wilson Decl.] ¶¶ 144; *see also* Pet., 46 (Ex. 1005 [Vijayan089] Fig. 7B with Petitioner’s annotations). The “time-frequency resource units” clearly refers to the four blackened boxes resembling a tetris symbol S rotated clockwise onto its side labeled 734. Each of the four black boxes is a transmission slot. Ex. 1005 [Vijayan089] ¶ 59 (“The allocated resources for each active PLC may be given in units of ‘transmission slots’ (or simply, ‘slots’).”). From this figure it can easily be seen that each slot has a duration of only one symbol period. *See* Ex. 1005 [Vijayan089] Fig. 7B. Since the slot is the alleged “time-frequency transmission unit,” and each symbol period is the duration of a single claimed “OFDM symbol,” this shows that the “time-frequency transmission unit” does not contain subcarriers in “a group of OFDM symbols” as required by the claim. Rather, the slot only lasts one symbol period so the alleged “time-frequency transmission unit” at most

¹ PLC is Physical Layer Channel Ex. 1005 [Vijayan089] ¶ 16.

contains a set of frequency subcarriers in a single OFDM symbol. Vijayan089 also states, “A slot corresponds to one group of (e.g., 500) data subbands or, equivalently, one group of modulation symbols in one symbol period.” Ex. 1005 [Vijayan089] ¶ 59. A POSITA would understand Vijayan089’s statement that a slot is “in one symbol period” to teach that each slot only contains one OFDM symbol.

4. Vijayan475

72. Figure 4 of Vijayan475 clearly shows that each of the slots covers only one symbol period. This is shown in the excerpt below:

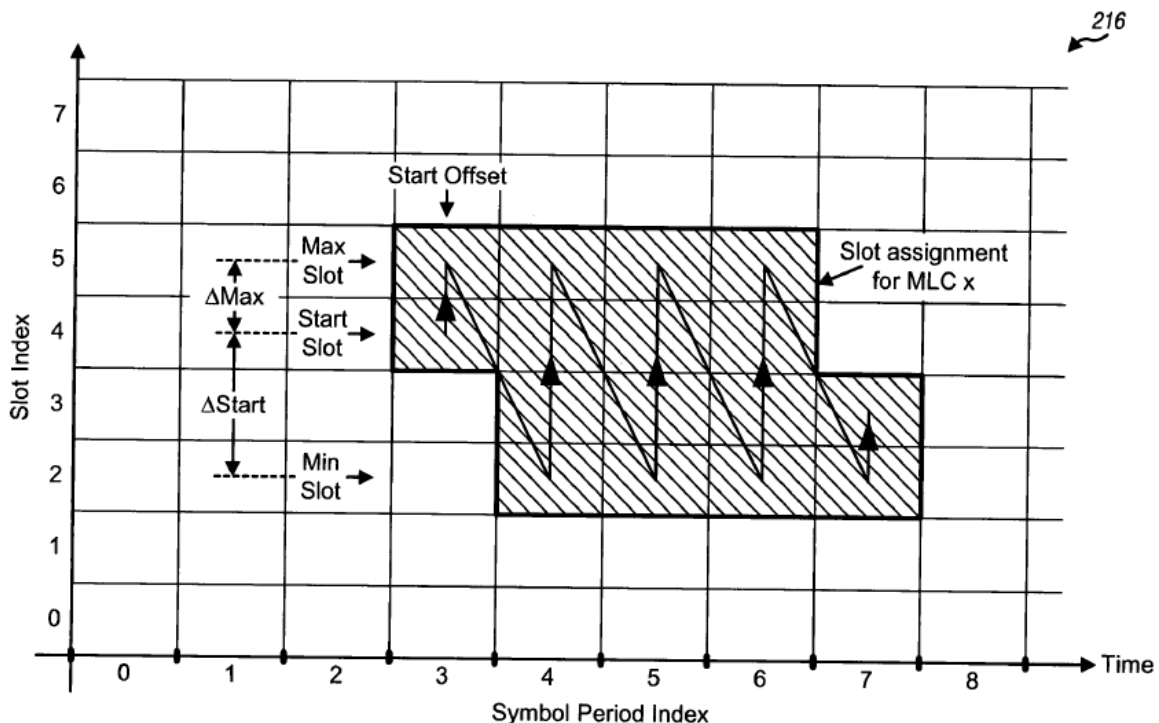
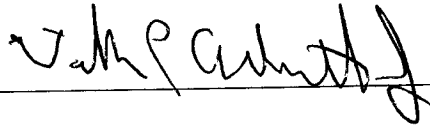


FIG. 4

Ex. 1006 [Vijayan475] Fig. 4. Figure 4 of Vijayan475 clearly shows that each of the slots covers only one symbol period.

VII. CONCLUSION

73. I hereby declare that all statements made herein of my own knowledge are true and all statements made herein on information and belief were and are believed by me to be true, and that all statements herein were and are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that any such willful false statements may jeopardize the validity of the application or any patents issued thereon.

DATED: July 10, 2023 SIGNED: 
William P. Alberth, Jr.