

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY, GENERAL MOTORS LLC, and
NISSAN NORTH AMERICA, INC.,
Petitioner,

v.

NEO WIRELESS, LLC
Patent Owner.

IPR 2023-00763
U.S. Patent No. 10,447,450 B2

SECOND DECLARATION OF TODOR COOKLEV

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List of Exhibits

Exhibit No.	Description
1001	U.S. Patent No. 10,447,450 (“450 Patent”)
1002	File History for U.S. Patent No. 10,447,450 (“450 FH”)
1003	Declaration of Dr. Todor Cooklev (“Cooklev Decl.”)
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”)
1009	Opinion and Order Granting in Part and Denying in Part Defendants’ Motion to Reduce Number of Asserted Claims (ECF No. 96), <i>In re Neo Wireless, LLC Patent Litig.</i> , No. 2:22-md-03034 (E.D. Mich. Nov. 18, 2022), ECF No. 99 (“ <i>In re Neo</i> Reduction of Asserted Claims Op. (ECF 99)”))
1010	Opinion and Order on Further Prior Art and Claim Narrowing, <i>In re Neo Wireless, LLC Patent Litig.</i> , No. 2:22-md-03034 (E.D. Mich. Dec. 9, 2022), ECF No. 102 (“ <i>In re Neo</i> Claim Narrowing Op. (ECF 102)”))
1011	Joint Claim Construction Statement, <i>In re Neo Wireless, LLC Patent Litig.</i> , No. 2:22-md-03034 (E.D. Mich. Jan. 18, 2023), ECF No. 114 (“Joint Claim Construction Statement”)
1012	United States District Courts – National Judicial Caseload Profile (Sept. 30, 2017–Sept. 30, 2022)
1013	Transfer Order, <i>In re Neo Wireless, LLC Patent Litig.</i> MDL No. 3034 (J.P.M.L. June 14, 2022), ECF No. 50 (“MDL Transfer Order”)

Exhibit No.	Description
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”)
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)
1018	Patent Owner’s Preliminary Response, <i>Volkswagen Grp. of Am., Inc. v. Neo Wireless, LLC</i> , IPR2022-01567 (Patent 10,447,450), Paper 7 (P.T.A.B. Feb. 8, 2023) (“IPR2022-01567, Paper 7 (POPR)”)
1019	Plaintiff Neo Wireless, LLC’s Opening Claim Construction Brief, <i>In re Neo Wireless, LLC Patent Litig.</i> , No. 2:22-md-03034 (E.D. Mich. Feb. 16, 2023), ECF No. 127 (“Neo Opening Claim Construction Brief”)
1020	Declaration of William Alberth in Support of Neo Wireless’s Opening Claim Construction Brief, <i>In re Neo Wireless, LLC Patent Litig.</i> , No. 2:22-md-03034 (E.D. Mich. Feb. 16, 2023), ECF No. 127-3 (“ <i>In re Neo</i> (ECF 127-3)”)
1021	Patent Owner’s Preliminary Response, <i>Dell, Inc. v. Neo Wireless, LLC</i> , IPR2021-01486 (Patent 10,447,450), Paper 7 (P.T.A.B. Dec. 20, 2021) (“IPR2022-01486, Paper 7 (POPR)”)
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”)

Exhibit No.	Description
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®</i> , <i>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 COMM’NS 307 (Feb. 2004) (“Falahati”)
1028	Sorour Falahati et al., <i>Adaptive Modulation Systems for Predicted Wireless Channels</i> , 52 IEEE TRANSACTIONS COMM’NS 307 (Feb. 2004) (“Falahati”)
1029	Declaration of Matt Ceglia (October 8, 2024) (the “Ceglia Declaration”)
1030	Full publicly available file history of US Patent No. 10,447,450 B2
1031	Second Declaration of Dr. Todor Cooklev
1032	ITU-APT Regional Seminar Program on Broadband Wireless Access Pacific Region Busan, Republic of Korea, 10 September 2004
1033	International Telecommunication Union (ITU) “About International Telecommunication Union” (Available at https://www.itu.int/en/about/Pages/default.aspx) Accessed March 24, 2025)
1034	Sandor Szabo et al., “Hiradastechnika”, Hírközlési és Informatikai Tudományos Egyesület (HTE) Journal Vol. LX August 2005

I, Todor Cooklev, hereby declare as follows:

1. I provided my background and qualifications in my original declaration dated March 28, 2023, Exhibit 1003.

2. In this Second Declaration, I respond to factual arguments and opinions expressed in Patent Owner's Response ("POR") dated December 30, 2024 and the cited exhibits, including Dr. Alberth's second declaration, Ex. 2023.

3. I note that the POR and Dr. Alberth only address the "mobile device" and "N=2, 4 or 8" limitations of '450 Patent claim 7. The POR and Dr. Alberth do not dispute the presence of other claim limitations of challenged claims 7 or 11 in the prior art, the level of skill in the art, or the reasons I provided for combining the references addressed in my original declaration. (Ex. 1003.) Thus, below, I focus my analysis on the "mobile device" and "N=2, 4 or 8" limitations of '450 Patent claim 7.

I. "mobile device"

A. Exhibit 1005 - Park

4. The portions of the POR directed to the "mobile device" limitation of claim 7, and the cited opinions of Dr. Alberth in Exhibit 2023, assert that Park's improvements to the band selection AMC region disclosed in Park Figure 1 are only "for fixed subscribers." (Ex. 2023, ¶51.) According to Patent Owner:

- “Park unambiguously teaches . . . that the band AMC region of the frame applies only to ‘fixed’ subscribers, **not** mobile subscribers.” (POR, 1, emphasis in original.)
- “Park teaches that its relied-upon embodiments exclusively apply to “fixed subscribers,” (POR, 5.)
- “Park’s teachings in its embodiments relied upon by Petitioner only apply to fixed subscribers.” (POR, 9-10.)
- “Park discloses that its invention applies to the resource allocation message for subscribers within the AMC area, which, Park explains, is only for ‘fixed subscribers.’” (POR, 11.)

5. The POR and Dr. Alberth cite a single statement for this argument, which is found in Park’s “Description of Related Art” referring to Figure 1, which Park describes as “PRIOR ART.” That statement is as follows:

The preamble area 11 is used for base station discrimination, channel estimation, synchronization information and system information transmission. The diversity area 12 is used for allocating resources for mobile subscribers, and ***the AMC area 13 is used for increasing the transmission speed through a frequency-Selective adaptive modulation for fixed subscribers.***

(Ex. 1005, [0011].)

6. This statement merely reports that, in the prior art, the AMC area is

“used for increasing the transmission speed” for fixed subscribers. This statement does not say that mobile devices cannot also use the AMC area. Other statements in Park’s “Description of Related Art” section teach that Park’s improvements may be applied to mobile devices:

Next-generation **mobile** communication systems will transmit data with superior quality at a high transmission rate to provide subscribers with various improved multimedia services. Recent studies are being conducted on an Orthogonal Frequency Division Multiple Access (OFDMA) scheme to make it possible for the next-generation **mobile** communication systems to meet the above expectations.

(Ex. 1005, [0005].) (Emphasis added.)

7. In addition, as stated in my original declaration, Park expressly applies his innovation to WiBro. (Ex. 1005, [0007], [0036], [0073], [0075].) The POR and Dr. Alberth acknowledge WiBro supported mobile devices. (POR, 1; Ex. 2023, ¶56.) Because Park applies its invention to WiBro devices that are already mobile, Park teaches a mobile device configured to perform Park’s invention, just like the challenged claims. A person of skill in the art would have understood, based on the teachings of Park, the software that would have performed Park’s invention would have been executed on a mobile device that is stationary or slowly moving. When a mobile device is stationary or moving slowly, it would have communicated using band AMC “for increasing the transmission speed.” Therefore, Park’s improvements

to band AMC would have been used by a mobile device while the device was stationary or slowly moving and the quality of the channel was sufficient. The boundary between low channel quality (experienced by a mobile device while moving) and sufficiently high channel quality (experienced by a mobile device while stationary) is not sharp. Consequently, I disagree with Dr. Alberth that “Petitioner has not shown a ‘mobile device’ that is configured to perform the recited claim limitations.” (Ex. 2023, ¶¶33, 44, 51).

8. Dr. Alberth devotes a significant part of his declaration trying to support his opinion that “Park’s embodiments only apply to fixed subscribers.” (Ex. 2023, ¶¶44-62). Dr. Alberth does not support his conclusion that “Petitioner has not shown a ‘Mobile Device’ that is configured to perform the recited claim limitations” for the simple reason that the device of Park is at times mobile and at other times stationary.

9. Because Park applies to WiBro, which both parties agree applies to mobile devices, a person of skill in the art would have understood the term “mobile” was used for devices that can move, but can also be stationary, for example smartphones. At the time of the invention there was very significant interest in providing Internet connectivity for such devices. Park applies to “Next-generation *mobile* communication systems will transmit data with superior quality at a high transmission rate to provide subscribers with various improved multimedia

services.” (Ex. 1005, [0005], emphasis added). As also acknowledged by Dr. Alberth, “the ’450 Patent admits that the claimed ‘mobile devices’ may be ‘fixed.” (Ex. 1001, 3:40-42; Ex. 2023, ¶89). By way of an example, smartphones are such devices.

10. The frame structure in Fig. 1 of Park has an area used when the device is moving (at relatively high speed) and an area used when the same device is stationary or slowly moving. “The diversity area 12 is used for allocating resources for mobile subscribers, and the AMC area 13 is used for increasing the transmission speed through a frequency-selective adaptive modulation for fixed subscribers.” (Ex. 1005, [0011]). The “mobile subscribers” in Park are not perpetually mobile. Sometimes, in fact often, they are stationary and then will use the AMC area of the superframe.

11. Based on the foregoing, the mobile device of Park is configured to use both areas of the superframe shown in Figure 1. Dr. Alberth wrongly asserts “Park teaches that its method only applies to fixed subscribers even in other systems such as WiBro that support mobile subscribers”¹ (Ex. 2023, ¶63) is not correct. Park’s mobile device is configured to use band AMC when the device is stationary or

¹ This sentence does not seem completely clear. It also appears to contradict Dr. Alberth’s paragraph 44 where he acknowledges that WiBro is not “another system”.

slowly moving.

12. Park alone teaches a mobile device because it applies to a mobile system such as WiBro and further, in Fig. 1, it teaches a frame structure that supports mobile devices. Therefore, Park does not need IEEE 802.16-2004 to teach a mobile device.

B. Exhibit 1023 – Introduction to WiBro Technology

13. I cited Exhibit 1023 in my original declaration with respect to the “mobile device” limitation of claim 7, asserting a person of skill in the art would have recognized that Park applies to mobile devices. (Ex. 1003, ¶126.) I also identified Exhibit 1023 during my deposition as providing the “technical characteristics” and “technical parameters” of WiBro that were known to those of skill in the art. (Ex. 2024, 110, 113.) Patent Owner did not address Ex. 1023 in the POR, and Dr. Alberth does not address the exhibit in his Second Declaration.

14. Exhibit 1023 is a presentation on WiBro technology presented by Soon Young Yoon from Samsung Electronics to the International Telecommunication Union (ITU) during Session 3 (from 2:00-4:00 pm) of the ITU-APT Regional Seminar on Broadband Wireless Access for Asia Pacific Region in Busan, Korea on September 10, 2004. (Ex. 1032.)

15. The ITU is a major international agency sponsored by the United Nations. The ITU has been in existence since 1865 and is currently made up of 194

Member States and more than 1000 companies. (Ex. 1033.) The ITU is a major standards development organization, among certain other activities. I have been aware of the ITU since the 1990s. In fact, I was an active participant in the ITU between 1999 and 2002. During that time, I attended several ITU meetings and I chaired a session on coding that took place in Antwerp, Belgium in June of 2000.

16. Exhibit 1023 is dated September 10, 2004 and lists on its cover an ITU seminar that took place at Samsung Electronics' Telecom R&D Center. (*See also*, Ex. 1032.) Exhibit 1023 includes a copyright notice listing Samsung Electronics Co., Ltd. Exhibit 1023 was posted on the ITU website and is still available.²

17. The ITU website has a search feature, and I was able to locate Exhibit 1023 on the ITU website by searching "WiBro," which was displayed as the first search result. While I am not aware of the precise date when Exhibit 1023 was uploaded to the ITU website, I am aware based on my past experiences with ITU seminars, including one that I personally chaired, that the ITU posts presentation materials to its website soon after the seminar at which they were presented and sometimes around the time of the seminar. Here, the meeting took place on September 10, 2004, more than a year before the September 28, 2005 priority date for the '450 Patent. Based on my experience with ITU conferences, Exhibit 1023

² https://www.itu.int/ITU-D/tech/events/2004/busan2004/session3_yoon.pdf

would have been published on ITU's website around or at most soon after September 2004, well before the September 28, 2005 priority date of the '450 Patent. This is confirmed by Exhibit 1034, which is an August 2005 publication of Volume LX of the Hírközlési és Informatikai Tudományos Egyesület (HTE) journal, ISSN 0018-2028.³ Founded in 1949, HTE is Hungary's Scientific Association for Infocommunications.⁴ As indicated on its cover, the August 2005 release is directed to 802.16, and includes a WiMAX related article by Szabo Sandor citing, as endnote [7], the publication marked as Exhibit 1023 in this proceeding. (Ex. 1034, p. 7.) Mr. Sandor's citation to Exhibit 1023 in the August 2005 release of the HTE journal confirms that Exhibit 1023 presented at the September 10, 2004 ITU conference was available and known to those of skill in the art before the priority date of the '450 Patent.

18. As is evident from the title and program for the September 10, 2004 ITU conference, it would have been attended by persons of skill in the art to which the challenged claims of the '450 Patent pertain, *i.e.*, "Broadband Wireless Access." (Ex. 1032.) At the time, before the advent of 4G Long-Term Evolution (LTE), WiBro was globally recognized as the highest-performing mobile communications

³ <https://real-j.mtak.hu/27944/>

⁴ <https://www.hte.hu/web/en>

network in the world and there was considerable interest in it. Exhibit 1023 would have been considered by a person skilled in the art as an authoritative document on WiBro because Exhibit 1023 was authored by an employee of Samsung, which was the major developer of WiBro and because it was presented to ITU. As such, Exhibit 1023 was a document a person skilled in the art would have consulted when seeking information about the workings of WiBro. In fact, I was aware of Exhibit 1023 prior to being engaged as an expert in this proceeding.

19. Exhibit 1023 confirms that a person of skill in the art reading Park would have known that mobile devices in WiBro leveraged the band selection AMC region described in Park.

PHY Characteristics (2)

❑ Performance Enhancement considering Mobility(1)

◆ H-ARQ

- Increase the efficiency of re-transmission resulting from fading and interference

◆ Band selection AMC & diversity subchannel

- Mobile stations request to select band selection AMC or diversity subchannel by monitoring channel status
- For slowly moving users : allocate band selection AMC subchannels which have high quality channel response to increase transmission efficiency and coverage
- For fast moving users : allocate diversity subchannels distributed over whole frequency band to maximize frequency diversity

(Ex. 1023, p. 17.) (Highlighting added.)

20. This evidence explains that channel status is monitored, and depending on that status, either band selection AMC or diversity channel will be used depending on whether the user is stationary, slowly moving, or fast moving. Based on this teaching, a person of skill in the art would have recognized that “slowly moving” “mobile stations” in WiBro leveraged band selection AMC and would have benefitted from Park’s innovation.

C. Exhibit 2027 – “WiBro-Article”

21. The POR and Dr. Alberth cite Exhibit 2027, titled “Capacity Analysis Considering Channel Resource Overhead for **Mobile** Internet Access (WiBro),” which they refer to as the “WiBro-Article.” Dr. Alberth cites Exhibit 2027 numerous times in his analysis. (Ex. 2023, ¶¶57-60, 78, 82, 84.)

22. A passage of Exhibit 2027, which Dr. Albert does not address, confirms the evidence in Exhibit 1023 that, in WiBro, mobile subscribers used the band selection AMC aspect and thus would have leveraged Park’s innovation.

23. Exhibit 2027 teaches that in the downlink “[t]he proportion of diversity to band selection can be changed every frame.” (Ex. 2027, p. 2.) This statement, like the statements in Exhibit 1023 shown above, confirms that all WiBro subscribers leverage both diversity selection and band selection AMC regardless of whether they were fixed or mobile.

24. The teachings of Park, Exhibit 1023, and Exhibit 2027 are consistent

with the recognition in the '450 Patent that “[o]ne or more mobile devices (not shown) may be fixed or may roam within the geographic region covered by the network. (Ex. 1001, 3:40-42.) The Patent Owner and Dr. Alberth agree that “a mobile device may be stationary at some times and mobile at other times.” (POR, 35; Ex. 2023, ¶ 86.) This provides further support for my opinion that Park’s innovation (and WiBro) applies to devices that are sometimes mobile and other times stationary or slowly moving.

D. Mobile Devices “in motion”

25. Patent Owner and Dr. Alberth assert that claim 7 requires the claimed mobile device to be “in motion.” (POR, 36; Ex. 2023, ¶ 86.) While I am not aware of any “in motion” limitation in claim 7, a person skilled in the art would have known that Park and WiBro, to which Park is expressly directed, permit even “moving users” to leverage band selection AMC. There is no basis for concluding they cannot, and Exhibits 1023 and 2027 confirm they did:

- Mobile stations request to select band selection AMC or diversity subchannel by monitoring channel status
- For slowly moving users : allocate band selection AMC subchannels which have high quality channel response to increase transmission efficiency and coverage

(Ex. 1023, p. 17.) (Highlighting added.)

E. 802.16e

26. Patent Owner and Dr. Alberth focus on the content of 802.16-2004 and

subsequent amendments including 802.16e. (Ex. 2023, ¶¶ 54, 68-69, 72.) But, my opinions with respect to the disputed limitations are based on Park, which improved on the utilization of band selection AMC and taught a person of skill in the art to apply his improvements to 802.16-2004, WiBro, and the “PRIOR ART” 802.16e frame illustrated in Figure 1. Dr. Albert confirms that 802.16e frame, having a diversity and band selection AMC area, “is similar to Park’s Figure 1.” (Ex. 2023, ¶56.)

27. I do not base my invalidity opinions in this matter on a publication of 802.16e. In my original declaration, I confirmed that 802.16e was not published until February 28, 2006⁵, *after* the September 28, 2005 priority date of the ’450 Patent. (Ex. 1003, ¶98.) I referenced the 802.16e amendment in my original declaration merely to “reinforce my conclusion that Park’s changes to 802.16-2004 will apply to mobile devices.” (Ex. 1003, ¶¶99-101.)

II. “N=2, 4 or 8”

28. The POR and Dr. Alberth do not dispute my opinion stated in my original declaration that Park discloses N=2, and other values of N. (Ex. 1003, ¶172.)

⁵ While it is true that 802.16e was not finalized before the priority date of the ’450 patent, WiBro (based on an early draft of 802.16e per Ex. 1023, p. 24) was available. And as explained above, Park relates to WiBro.

29. Instead, POR and Dr. Alberth assert that “N must be selected from N = 2, 4 or 8, excluding other plural numbers.” (POR, 37; Ex. 2023, ¶¶ 88-89.) Because Park discloses values in addition to 2, 4 or 8, the POR and Dr. Albert assert Park fails to teach that limitation of claim 7.

30. While I am not a patent lawyer, I can say as a person of skill in the art, nothing in claim 7 indicates that N is limited to only 2, 4 or 8. I am not aware of a reasoned basis for a person of skill in the art to conclude that a system supporting N=2, 4 or 8 would be excluded from claim 7 merely because it supports a value for N in addition to those values.

31. The '450 Patent specification contemplates values of N beyond 2, 4 or 8. Table 1, for example, describes N=1. ('450 Patent, 6:35-45.) Table 1 provides “representative” modulating and coding schemes (“MCS”), indicating to a person of skill in the art that other values may be used. ('450 Patent, 6:31-33.) The specification also explains that “other MCS” values may be implemented that are “simply an integer multiple of the basic unit.” ('450 Patent, 6:52.) The specification explains, “[i]n practice, different voice packets may be transmitted using different MCSs, some with MCSI = 1, some with MCSI = 4, so on so forth.” ('450 Patent, 7:34-37.)

32. A person of skill in the art reading Table 1 and these passages, together with the language of claim 7, would not conclude that claim 7 is limited to “only”

N=2, 4 or 8 as Patent Owner asserts.

33. The POR and Dr. Alberth discuss advantages of a system having N=2, 4 or 8, which they contend are not achieved by Park. (POR, 41-45; Ex. 2023, ¶¶93-99.) I disagree with Dr. Alberth for two independent reasons. First, claim 7 does not require these benefits. Second, the asserted advantages of N=2, 4 or 8 apply to other values of N.

34. Dr. Alberth asserts that “[t]he choice of N=2, 4 or 8 is not arbitrary; rather, it was a deliberate selection that followed from the specific choice of time-frequency unit granularity the inventors discovered had additional benefits.” (Ex. 2023, ¶ 101.) I understand that Dr. Alberth tries to outline these additional alleged benefits in paragraph 92 of his declaration: “The specification confirms that the value of N, when plural, is limited to 2, 4 or 8. As described below, by limiting N, when plural, in the manner described, the invention achieves benefits beyond Park’s basic indexing of its ‘allocation units.’ First, limiting N may further reduce overhead by linking the segment size to the modulation scheme. Second, limiting N may remedy the prior art’s ‘irregular’ arrangement of segments.” (Ex. 2023, ¶92.) I disagree with these opinions even putting aside the fact that Dr. Alberth does not explain why these benefits are achieved “by limiting N, when plural, in the manner described” (and therefore his opinion would be unsupported). In fact, Dr. Alberth does not explain these benefits at all. Both of these alleged benefits appear to be

made up.

35. But, even assuming *arguendo* that these are actual benefits, Dr. Alberth provides no reason that they are “additional” benefits that can only be achieved when $N=2, 4, \text{ or } 8$. There are no such “additional” benefits. Both “linking the segment size to the modulation scheme” and fixing the “irregular arrangement of segments” can be obtained by other integer values of N . N is a result of choosing the modulation and coding scheme assuming a certain basic resource unit. Limiting N to 2, 4, or 8 is equivalent to certain combinations of modulation and coding. In ¶ 37-38, *infra*, I construct examples for $N=16$ and $N=3$ that achieve the same benefits.

36. Patent Owner and Dr. Alberth admit “[t]he Institution Decision is correct that for other modulation schemes or for other types of data different values of N may be beneficial.” (POR, 48; Ex. 2023, ¶101.) A person of skill in the art reading the ’450 Patent would have recognized it is a simple exercise to extend Table 1 and obtain other numbers of time-frequency resource units that may be implemented and achieve the same benefit.

37. For instance, continuing with the same example of 160 information bits provided in Table 1, a person of skill in the art would have recognized that if the

modulation is BPSK, and the coding rate $1/8$, the result is 1280^6 symbols, which corresponds to $N=16$. This value preserves the modularity as $N=16$ is an integer multiple of the basic unit as taught in the '450 Patent.

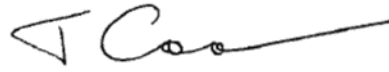
38. There are no advantages that are limited to only the coding rate values given in Table 1 ($1/2$, $1/4$, and $1/8$) that are not available for other values not listed in the table. For example, coding at a rate of $1/3$ (which, assuming the same basic resource unit as in Table 1 and QPSK, would result in $N=3^7$) would have performance between the performance of coding at rates $1/2$ and $1/4$ disclosed in Table 1.

⁶ 160 information bits multiplied by 8 (and divided by 1 because BPSK encodes 1 bit per symbol) results in 1280 symbols, which is 16 times the basic resource unit of 80 symbols.

⁷ This is computed similarly. 160 information bits multiplied by 3 and divided by 2 (because the modulation is QPSK) results in 240 symbols, which is three times the basic resource unit of 80 symbols.

I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.

Executed on: March 24, 2025

A handwritten signature in black ink, appearing to read 'T Cooklev', written over a horizontal line.

Todor Cooklev, Ph.D.