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UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	061240-8017.US06
	First Named Inventor	Xiaodong Li
	Title	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH P
	Express Mail Label No.	Via EFS-Web

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
1. ☐ Fee Transmittal Form (PTO/SB/17 or equivalent) 2. ☒ Applicant asserts small entity status. See 37 CFR 1.27 3. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent. 4. ☒ Specification [Total Pages <u>23</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement) 5. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>12</u>] 6. Inventor's Oath or Declaration [Total Pages <u>4</u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63(d)) 7. ☒ Application Data Sheet * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent) 8. CD-ROM or CD-R in duplicate, large table, or Computer Program (Appendix) ☐ Landscape Table on CD 9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PAPERS 10. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 11. ☒ 37 CFR 3.73(c) Statement ☒ Power of Attorney (when there is an assignee) 12. ☐ English Translation Document (if applicable) 13. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 14. ☐ Preliminary Amendment 15. ☐ Return Receipt Postcard (MPEP § 503) (Should be specifically itemized) 16. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 17. ☐ Nonpublication Request Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 18. ☐ Other: _____ _____ _____ _____

*Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 must be included in an Application Data Sheet (ADS).
 (2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS					
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Signature	/Stephen Bishop/		Date	14 August 2017	
Name (Print/Type)	Stephen Bishop		Registration No. (Attorney/Agent)	38,829	

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:



Practitioners associated with the Customer Number:

25096

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:



The address associated with Customer Number:

25096

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Firm or Individual Name

Address

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Assignee Name and Address:

Neocific, Inc.
13312 SE 43rd Street
Bellevue, Washington 98006

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	1/3/2007
Name	XIAODONG LI	Telephone	425-445-2270
Title	PRESIDENT		

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Neocific, Inc.

Application No./Patent No.: Not Yet Assigned Filed/Issue Date: Concurrently Herewith

Titled: METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

Neocific, Inc., a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 023455, Frame 0173, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Stephen Bishop/

14 August 2017

Signature

Date

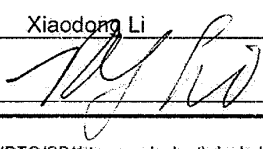
Stephen Bishop

38,829

Printed or Typed Name

Title or Registration Number

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD	
As the below named inventor, I hereby declare that: This declaration ☐ The attached application, or is directed to: ☒ United States application or PCT international application number <u>14/248,243</u> filed on <u>04/08/2014</u> The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment. I acknowledge the duty to disclose information material to patentability as defined in 37 C.F.R. 1.56 including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.		
LEGAL NAME OF INVENTOR		
Inventor:	<u>Xiaodong Li</u>	Date: <u>5/6/2014</u>
Signature:		
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.		

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

**Title of
Invention**

**METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH
REDUCED OVERHEAD**

As the below named inventor, I hereby declare that:

This declaration ☐ The attached application, or
is directed to:

☒ United States application or PCT international application number 14/248,243
filed on 04/08/2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment.

I acknowledge the duty to disclose information material to patentability as defined in 37 C.F.R. 1.56 including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

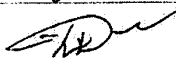
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LEGAL NAME OF INVENTOR

Inventor: Haiming Huang

Date: 5/6/2014

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA-01 form for each additional inventor.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

**Title of
Invention**

**METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH
REDUCED OVERHEAD**

As the below named inventor, I hereby declare that:

This declaration
is directed to:

☐

The attached application, or

☒

United States application or PCT international application number 14/248,243
filed on 04/08/2014

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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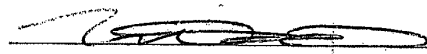
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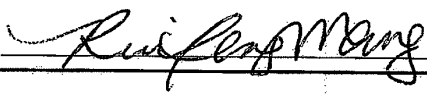
LEGAL NAME OF INVENTOR

Inventor: Titus Lo

Date: 4/12/2014

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
As the below named inventor, I hereby declare that: This declaration ☐ The attached application, or is directed to: ☒ United States application or PCT international application number <u>14/248,243</u> filed on <u>04/08/2014</u> The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment. I acknowledge the duty to disclose information material to patentability as defined in 37 C.F.R. 1.56 including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR Inventor: <u>Ruifeng Wang</u> Date: <u>4/11/2014</u> Signature: <u></u> Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application is a continuation of, and incorporates by reference in its entirety, U.S. Patent Application No. 14/720,554, filed on May 22, 2015, which is a continuation of U.S. Patent Application No. 14/248,243, filed on April 8, 2014, now U.S. Patent No. 9,042,337, which is a continuation of U.S. Patent Application No. 13/115,055, filed on May 24, 2011, now U.S. Patent No. 8,693,430, which is a continuation of U.S. Patent Application No. 11/908,257, filed on July 14, 2008, now U.S. Patent No. 7,948,944, which is a national stage application of PCT/US06/38149, filed September 28, 2006, which claims the benefit of U.S. Provisional Patent Application No. 60/721,451, filed on September 28, 2005.

[0002] This application is related to, and incorporates by reference in its entirety, U.S. Patent Application No. 13/631,735, filed on September 28, 2012, now U.S. Patent No. 8,634,376.

TECHNICAL FIELD

[0003] The disclosed technology relates, in general, to wireless communication and, in particular, to multi-carrier packet communication networks.

BACKGROUND

[0004] Bandwidth efficiency is one of the most important system performance factors for wireless communication systems. In packet based data communication, where the traffic has a bursty and irregular pattern, application payloads are typically of different sizes and with different quality of service (QoS) requirements. In order to accommodate

different applications, a wireless communication system should be 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.

[0005] 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, each connection includes the identification of an airlink resource that can correspond to any time/frequency region that is allocated for communication. The resource allocation is identified in the time domain scale with a start symbol offset (8 bits) and a symbol length (7 bits) and in the frequency domain scale with a start logical subchannel offset (6 bits) and a number of allocated subchannels (6 bits). Due to the fact that different applications have different resource requirements, the allocated resource region is irregular from connection to connection. As a still further example, the modulation and coding scheme for each connection is identified by a 4-bit MCS code, identified as either a downlink interval usage code (DIUC) or an uplink interval usage code (UIUC). Another 2 bits are used to indicate the coding repetition in addition to 3 bits for power control. Overall, the overhead of a MAP message is 52 bits. For applications such as voice-over-IP (VoIP), the payload of an 8Kbps voice codec is 20 bytes in every 20ms. The overhead of the MAP message alone can therefore account for as much as 32.5% of the overall data communication, thereby resulting in a relatively low spectral efficiency. It would therefore be beneficial to reduce the overhead in a multi-carrier packet communication system to improve the spectral efficiency of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Figure 1 illustrates the coverage of a wireless communication network that is comprised of a plurality of cells.

[0007] Figure 2 is a block diagram of a receiver and a transmitter, such as might be used in a multi-carrier wireless communication network.

[0008] Figure 3 is a block diagram depicting a division of communication capacity in a physical media resource.

[0009] Figure 4 is a graphical depiction of the relationship between a sampling frequency, a channel bandwidth, and usable subcarriers in a channel.

[0010] Figure 5 is a graphical depiction of the structure of a multi-carrier signal in the frequency domain.

[0011] Figure 6 is a block diagram of a time-frequency resource utilized by a wireless communication network.

[0012] Figure 7 is a block diagram of a classifier for classifying received packets by application, QoS, or other factor.

[0013] Figures 8A and 8B are block diagrams of representative control message formats.

[0014] Figure 9 is a block diagram of a special resource zone with unit sequence defined in time-first order.

[0015] Figures 10A-10C are block diagrams illustrating the reallocated of resources within a resource zone.

DETAILED DESCRIPTION

[0016] A system and method for minimizing the control overhead in a multi-carrier wireless communication network that utilizes a time-frequency resource is disclosed. In some embodiments, one or more zones in the time-frequency resource are designated for particular applications, such as a zone dedicated for voice-over-IP (VoIP) applications. By

grouping applications of a similar type together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a portion of the time-frequency resource can be achieved. In some embodiments, modular coding schemes associated with the packet streams may be selected that further reduce the amount of necessary control information.

[0017] In some embodiments, packets may be classified for transmission in accordance with application type, QoS parameters, and other properties. An application connection-specific identifier (ACID) may also be assigned to a packet stream. Both measures reduce the overhead associated with managing multiple application streams in a communication network.

[0018] In some embodiments, improved control messages may be constructed to facilitate the control process and minimize associated overhead. The control messages may include information such as the packet destination, the modulation and coding method, and the airlink resource used. Control messages of the same application type or subtype, modulation and coding scheme, or other parameter may be grouped together for efficiency.

[0019] While the following discussion contemplates the application of the disclosed technology to an Orthogonal Frequency Division Multiple Access (OFDMA) system, those skilled in the art will appreciate that the technology can be applied to other system formats such as Code Division Multiple Access (CDMA), Multi-Carrier Code Division Multiple Access (MC-CDMA), or others. Without loss of generality, OFDMA is therefore only used as an example to illustrate the present technology. In addition, the following discussion uses voice-over-IP as a representative application to which the disclosed technology can be applied. The disclosed technology is equally applicable to other applications including, but not limited to, audio and video.

[0020] The following description provides specific details for a thorough understanding of, and enabling description for, various embodiments of the technology. One skilled in the art will understand that the technology may be practiced without these details. In some instances, well-known structures and functions have not been shown or described in detail to avoid unnecessarily obscuring the description of the embodiments of the technology. It is intended that the terminology used in the description presented below be interpreted in

its broadest reasonable manner, even though it is being used in conjunction with a detailed description of certain embodiments of the technology. Although certain terms may be emphasized below, any terminology intended to be interpreted in any restricted manner will be overtly and specifically defined as such in this Detailed Description section.

I. Wireless Communication Network

[0021] Figure 1 is a representative diagram of a wireless communication network 100 that services a geographic region. The geographic region is divided into a plurality of cells 105, and wireless coverage is provided in each cell by a base station (BS) 110. One or more mobile devices (not shown) may be fixed or may roam within the geographic region covered by the network. The mobile devices are used as an interface between users and the network. Each base station is connected to the backbone of the network, usually by a dedicated link. A base station serves as a focal point to transmit information to and receive information from the mobile devices within the cell that it serves by radio signals. Note that if a cell is divided into sectors, from a system engineering point of view each sector can be considered as a cell. In this context, the terms “cell” and “sector” are interchangeable.

[0022] In a wireless communication system with base stations and mobile devices, the transmission from a base station to a mobile device is called a downlink (DL) and the transmission from a mobile device to a base station is called an uplink (UL). Figure 2 is a block diagram of a representative transmitter 200 and receiver 205 that may be used in base stations and mobile devices to implement a wireless communication link. The transmitter comprises a channel encoding and modulation component 210, which applies data bit randomization, forward error correction (FEC) encoding, interleaving, and modulation of an input data signal. The channel encoding and modulation component is coupled to a subchannel and symbol construction component 215, an inverse fast Fourier transform (IFFT) component 220, and a radio transmitter component 225. Those skilled in the art will appreciate that these components construct and transmit a communication signal containing the data that is input to the transmitter 200. Other forms of transmitter may, of course, be used depending on the requirements of the communication network. :

[0023] The receiver 205 comprises a reception component 230, a frame and synchronization component 235, a fast Fourier transform component 240, a frequency, timing, and channel estimation component 245, a subchannel demodulation component 250, and a channel decoding component 255. The channel decoding component de-interleaves, decodes, and derandomizes a signal that is received by the receiver. The receiver recovers data from the signal and outputs the data for use by the mobile device or base station. Other forms of receiver may, of course, be used depending on the requirements of the communication network.

[0024] Figure 3 is a block diagram depicting the division of communication capacity in a physical media resource 300 (e.g., radio or cable) into frequency and time domains. The frequency is divided into two or more subchannels 305, represented in the diagram as subchannels 1, 2,...m. Time is divided into two or more time slots 310, represented in the diagram as time slots 1, 2,...n. The canonical division of the resource by both time and frequency provides a high degree of flexibility and fine granularity for resource sharing between multiple applications or multiple users of the resource.

[0025] Figure 4 is a block diagram representing the relationship between the bandwidth of a given channel and the number of usable subcarriers within that channel. A multi-carrier signal in the frequency domain is made up of subcarriers. In Figure 4, the sampling frequency is represented by the variable f_s , the bandwidth of the channel is represented by the variable B_{ch} , and the effective bandwidth by the variable B_{eff} (where the effective bandwidth is a percentage of the channel bandwidth). The number of usable subcarriers within the channel is defined by the following equation:

$$\#_usable_subcarriers = \frac{B_{eff}}{f_s} \times N_{fft}$$

Where N_{fft} is the length of the fast Fourier transform. Those skilled in the art will appreciate that for a given bandwidth of a spectral band or channel (B_{ch}), the number of usable subcarriers is finite and limited, and depends on the size of the FFT, the sampling frequency (f_s), and the effective bandwidth (B_{eff}) in accordance with equation 1.

[0026] Figure 5 is a signal diagram depicting the various subcarriers and subchannels that are contained within a given channel. There are three types of subcarriers: (1) data

subcarriers, which carry information data; (2) pilot subcarriers, whose phases and amplitudes are predetermined and made known to all receivers, and which are used for assisting system functions such as estimation of system parameters; and (3) silent subcarriers, which have no energy and are used for guard bands and as a DC carrier. The data subcarriers can be arranged into groups called subchannels to support scalability and multiple-access. The subcarriers forming one subchannel may or may not be adjacent to each other. Each mobile device may use some or all of the subchannels.

[0027] A multi-carrier signal in the time domain is generally made up of time frames, time slots, and OFDM symbols. A frame consists of a number of time slots, and each time slot is comprised of one or more OFDM symbols. The OFDM time domain waveform is generated by applying an inverse-fast-Fourier-transform (IFFT) to the OFDM symbols in the frequency domain. A copy of the last portion of the time domain waveform, known as the cyclic prefix (CP), is inserted in the beginning of the waveform itself to form an OFDM symbol.

[0028] In some embodiments, a mapper such as the subchannel and symbol construction component 215 in Figure 2 is designed to map the logical frequency/subcarrier and OFDM symbol indices seen by upper layer facilities, such as the MAC resource scheduler or the coding and modulation modules, to the actual physical subcarrier and OFDM symbol indices. A contiguous time-frequency area before the mapping may be actually discontinuous after the mapping, and vice versa. On the other hand, in a special case, the mapping may be a “null process”, which maintains the same time and frequency indices before and after the mapping. The mapping process may change from time slot to time slot, from frame to frame, or from cell to cell. Without loss of generality, the terms “resource”, “airlink resource”, and “time-frequency resource” as used herein may refer to either the time-frequency resource before such mapping or after such mapping.

II. Airlink Resource Zones

[0029] Various technologies are now described that may be utilized in conjunction with the wireless communication network 100 in order to reduce the amount of control

overhead associated with the use of system resources. By reducing the control overhead, greater spectral efficiency is achieved allowing the system to, among other benefits, maximize the amount of simultaneously supported communications.

[0030] Figure 6 is a map of a time-frequency resource 600 that is allocated for use by the wireless communication network 100. As described above, in a typical wireless system based on the IEEE 802.16 standard ("WiMAX"), multiple packet streams are established for each mobile device to support different applications. At the medium access control (MAC) layer, each packet stream is mapped into a wireless connection. As a result, various applications carried in packet streams may be spread throughout the available time-frequency resource. To overcome the inefficiencies associated with maintaining this mapping, Figure 6 depicts an alternative way of managing multiple packet streams. The time-frequency resource 600 may be divided into one or more zones 605a, 605b,...605n. Each of the zones 605a, 605b,...605n is associated with a particular type of application. For example, zone 605a may be associated with voice applications (e.g., VoIP), zone 605b may be associated with video applications, and so on. As will be described in additional detail below, by grouping like applications together the amount of control overhead in MAC headers is reduced. Zones may be dynamically allocated, modified, or terminated by the system.

[0031] When applications of a similar type are grouped together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a time-frequency segment can be achieved. 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. If the time-frequency resource is divided into two or more zones, the amount of control information necessary to map to a location relative to the starting point of the zone may be significantly less than the amount of information necessary to map to an arbitrary starting and ending coordinate in the entire time-frequency resource.

[0032] Within each zone 605a, 605b,...605n, the time-frequency resource may be further divided in accordance with certain rules to accommodate multiple packet streams $V_1, V_2, \dots V_m$. For example, as depicted in Figure 6, zone 605a is divided into multiple columns and the packet streams are arranged from top down in each column and from left to right across the columns. The width of each column can be a certain number of subcarriers. Each packet stream $V_1, V_2, \dots V_m$ may be associated with an application. For example, V_1 is the resource segment to be used for the first voice packet stream, V_2 is the resource segment to be used for the second voice packet stream, etc. While the zone 605a is divided and the packet streams numbered starting at an origin of the zone, it will be appreciated that the division of the time-frequency resource in accordance with certain rules may start at other origin locations within the zone as well. Segments within each zone may be dynamically allocated by the system as requested and released by the system when expressly or automatically terminated.

[0033] When the zones are further subdivided into time-frequency segments in accordance with certain rules, a mapping of packet streams to segment may be achieved using a one-dimensional offset with respect to the origin of the zone rather than the two-dimensional (i.e. starting time-frequency coordinate and ending time-frequency coordinate relative to the starting point of the zone) mapping method discussed above. Calculation of such an offset may require knowledge of a modulation and coding scheme that is associated with a particular packet stream. For example, Table 1 below sets forth representative modulation and forward-error correction (FEC) coding schemes (MCS) that may be used for voice packet streams under various channel conditions.

Table 1

MCSI	Modulation	Coding rate	Information bits	Raw symbols	Units
1	16QAM	1/2	160	80	1
2	QPSK	1/2	160	160	2

3	QPSK	1/4	160	320	4
4	QPSK	1/8	160	640	8

[0034] In some embodiments, the MCS may be selected to utilize modular resources. For example, as illustrated in Table 1, 80 raw modulation symbols are needed to transmit 160 information bits using 16QAM modulation and rate- $\frac{1}{2}$ coding, the highest available MCS in the table. The resource utilized by this highest MCS is called a basic resource unit ("Unit"), i.e., 80 raw symbols in this example. The resource utilized by other MCS is simply an integer multiple of the basic unit. For example, four units are required to transmit the same number of information bits using QPSK modulation with rate- $\frac{1}{4}$ coding. The MCS index (MCSI) conveys the information about modulation and coding schemes. For a known vocoder, MCSI also implies the number of AMC resource units required for a voice packet. Those skilled in the art will appreciate that coding and signal repetition can be combined to provide lower coding rates. For example, rate- $\frac{1}{8}$ coding can be realized by a concatenation of rate- $\frac{1}{2}$ coding and 4-time repetition.

[0035] The decision process for selecting the proper MCS of a packet can vary by application. In some embodiments, the process for voice packets can be more conservative than that for general data packets due to the QoS requirements of the voice applications. For example, when the signal to interference noise ratio (SINR) is used as a threshold for selecting the MCS, the threshold value for voice packets is set higher than that for general data packets. For example, the SINR threshold of QPSK with rate- $\frac{1}{2}$ coding for voice packets is 12 dB, while that for general data packets is 10 dB.

[0036] 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.

[0037] 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 the zone 605a. For example, to support a maximum of 64 VoIP calls in a cell, a maximum of $64 \times 8 = 512$ units might be used, assuming that every voice packet is transmitted using the lowest MCS. Therefore, a 9-bit number is sufficient to represent a VZI. In practice, different voice packets may be transmitted using different MCSs, some with $MCSI=1$, some with $MCSI=4$, so on so forth. According to statistics, a shorter bit-length than the maximum needed, for example 8 bits, may be used for VZI for practical purpose.

[0038] In some embodiments, control information necessary to map a packet stream to a resource segment may be still further reduced. In the case where an MCS is used with packet streams that are located sequentially in the zone, the index of a packet can be inferred from the MCSI of the packets located before the subject packet. For example, if the first voice packet stream uses $MCSI_1=1$, 16QAM with $\frac{1}{2}$ coding, and the second voice packet stream uses $MCSI_2=4$, QPSK with $\frac{1}{8}$ coding, then the first two voice packet streams occupy $1+8=9$ units, and the starting location of the third voice packet stream is the 9th unit. Rather than encode the index for each packet stream in the control information, the index can be omitted in the control message and the offset from the origin of the zone calculated as necessary.

[0039] Allocation of the time-frequency resource 600 can be carried out in a variety of ways. In some embodiments, an application zone may contain all subcarriers of one or multiple OFDM symbols or time slots. In some embodiments, the definition of an application zone, such as the location and size of the zone, may be different from cell-to-cell 105. In some embodiments, in order to avoid inter-cell interference the zones of

similar applications are allocated at different locations in neighboring cells. For example, voice applications may be located at a lower frequency range in the time-frequency resource in one cell, and at a higher frequency range in the time-frequency range in an adjacent cell. In some embodiments, the system allocates a fixed amount of resource to each voice connection. The system uses AMC and matches it with adaptive multi-rate (AMR) voice coding to improve the voice quality. Moreover, unused resources in one application zone may be allocated for other applications.

[0040] In a system with one or multiple application zones, the remaining resource unused by the application zones can be treated as a special resource zone. The special resource zone may be irregular in shape. For example, Figure 9 depicts a time-frequency resource 900 having three defined zones 905, 910, and 915. The remaining resource area that is shaded in the figure represents the special resource zone. The MAC scheduler may track the time-frequency resources in this special zone and broadcast the resource allocation in a special zone MAP message. In some embodiments, the special zone MAP message explicitly identifies the resource zone, for example using the time and frequency coordinates of a resource block. A mobile device can identify its own resource by decoding the MAP message.

[0041] In some embodiments, both the base station and the mobile device share the configuration information of the special resource zone, and view the special zone as a contiguous resource zone. The MAP message only includes the resource allocation information in the special resource zone, using connection ID (described below), resource identification parameters and MCS index.

[0042] In some embodiments, the MAP message can be further compressed if the special resource zone is further divided into a sequence of pre-defined resource units. For example, the shaded area in Figure 9 has been further divided into forty-two resource units 920, first numbered sequentially along the time axis and then continuing in columns along the frequency axis. If the size of each resource unit is pre-defined, the location within the special resource zone may be determined based on a mapping to a sequence number.

III. Application Connection IDs

[0043] When a mobile device enters a wireless network, it is first assigned a basic connection identification (BCID) for each direction of the wireless connection: downlink and uplink. A BCID can be used for control messages or generic (unclassified) application connections. The BCID for downlink may or may not be the same as that of the uplink.

[0044] In some embodiments, a classification of packet streams may be performed by the system. Figure 7 is a block diagram of a system component 700 for receiving IP packets and sorting the received packets into various streams. The system component 700 includes a classifier 705 having associated classification rules 710. The classifier receives incoming packets, each packet having various header information such as an Ethernet header 715, an IP header 720, a UDP header 725, an RTP header 730 and an RTP payload 735. The packets are classified by the classifier 705 and output into different application data queues 740 where they will subsequently be transmitted by an OFDMA transmitter 745.

[0045] The classifier 705 is able to classify the packets based on application type, quality of service (QoS) requirement, or other properties. For example, packets from a voice application stream are identified based on a special value in the type of service (ToS) field in the IP header 720 of the packets. A new combination of RTP/UDP/IP headers with the special IP ToS field value indicates a new voice application stream. Such a new stream is identified by peeking into voice session setup protocol messages, such as session initiation protocol (SIP). The classification performed by the classifier is based on one or more classification rules 710. The classification rules can be configured statically or dynamically by a control process. Each classification rule is defined using parameters, such as application type, QoS parameters, and other properties that may be determined from the received packets.

[0046] In some embodiments, the incoming packets may also be assigned an application connection-specific identifier (ACID) in addition to or in lieu of a BCID. Each ACID can be assigned to a corresponding packet stream. For example, an ACID can be assigned to voice packets that together make up a voice application. When an ACID is assigned to a voice application, the ACID may also be referred to as a voice connection ID

(VCID). As another example, an ACID can be assigned to a packet stream that requires a particular QoS. Furthermore, an application packet stream can be further classified into different sub-types, based on certain properties of that application. For example, voice applications can be further classified into different sub-types based on the voice source coding (vocoder) methods (e.g., G.711 and G.729A). When further classified in this matter, the sub-types may each be assigned their own ACID. For certain multi-casting applications, an ACID may also be shared by multiple base stations or mobile devices.

[0047] Once established, the connection IDs, including BCIDs and ACIDs, are disseminated, through broadcasting messages for example, to the corresponding base station(s) and mobile device(s) for proper packet transmission and reception. As was previously discussed, the medium access control (MAC) scheduler may allocate specific zones of airlink resources for certain types of packet streams.

[0048] A connection ID is released once the wireless system determines that there is no need to continue the connection. For example, a voice connection and its VCID are released once the system detects deactivation of the voice stream. In some embodiments, the voice connection is deactivated if the voice session disconnect is detected through snooping SIP signaling. In some embodiments, the voice connection is released if there is no voice packet activity on the connection for a certain period of time.

[0049] In some embodiments, the same bit length is used in different types of connections IDs, including BCIDs and ACIDs. In some embodiments, different types of connection IDs may have different bit lengths. For example, in a typical implementation for voice applications, a BCID may be 16-bits to accommodate a large number of mobile devices and unclassified applications, while a VCID is 6-bits to accommodate up to 64 simultaneous voice connections in a cell. A shorter ACID length is beneficial for reducing control overhead, especially when an application utilizes many small data packets, such as VoIP packets.

[0050] In some embodiments, an ACID is further augmented by other properties of the utilized airlink resources, such as time or frequency indices, to identify an application connection. This can be used to further reduce ACID bit length or to increase the maximum number of accommodated application connections given a certain ACID bit

length. For example, a voice codec generates voice application data periodically. The allocation period is usually a multiple of the airlink frame duration. In this case, the airlink frame number can be combined with a VCID to identify a voice connection. For example, the voice codec of G.723.1 generates a voice frame once every 30 milliseconds. The MAC scheduler allocates airlink resource to such a voice connection once every 30ms. In a wireless cellular system using 5ms frame duration, a single VCID can be shared by 6 voice streams, each associated with a different frame number to uniquely identify a voice connection.

IV. Control Messages

[0051] When airlink resource zones or application-specific IDs are utilized by the system, various improved control messages, often called Information Elements (IEs), may be constructed to facilitate the control process and minimize the control overhead. Various control message improvements are described herein.

[0052] In some embodiments, the IE is sent prior to transmitting an application packet to indicate information associated with the packet, such as the packet destination, the modulation and coding method, and the airlink resource used. For example, the IE for a voice packet may include the VCID (indicative of the packet destination), the MCSI (encoding scheme), and the VZI (index to location for the packet stream within the airlink resource). In some embodiments, the VCID is 6 bits, the MCSI is 2 bits, and the VZI is 8 bits, thereby resulting in a 2-byte IE overhead for each voice packet. Alternatively, the IE for a voice packet may include only the VCID and the MCSI, with the VZI inferred from the MCSIs of previous packet streams in the airlink resource as described above. When using only the VCID and MCSI, the IE overhead for each voice packet is reduced to only 1 byte. Additional control information, such as power control information, can be added to the IE with additional bit fields. The reduction in control bits improves the overall bandwidth efficiency of the wireless communication network.

[0053] In some embodiments, a base station sends the IE before a downlink packet to inform the mobile device for proper reception of the packet, and the base station sends the IE before an uplink packet to inform the mobile device for proper transmission of the

packet. The downlink and uplink packet IEs may be separately grouped together. The IEs may be broadcasted or multi-casted to corresponding destinations.

[0054] In some embodiments, the IEs of the same application type or subtype may be grouped together. A special field, called an Application MAP (AMAP) subheader, for a specific application type, may be added to the IE. The subheader may indicate the application type and the length of the IE group. Figure 8A is a block diagram of a representative IE 800 with an AMAP subheader 805, in this case used for voice applications. The AMAP subheader 805 includes a type variable and a length variable. As depicted in Figure 8A, type = 01 indicates that the application type is voice. Length = 3 indicates that the subheader is followed by three voice IEs. The remainder of the IE contains the three voice IEs 810a, 810b, and 810c. For example, if the AMAP subheader was associated with streams in the zone 605a depicted in Figure 6, then voice IE 810a would pertain to packet stream V_1 , voice IE 810b would pertain to packet stream V_2 , and voice IE 810c would pertain to packet stream V_3 . Those skilled in the art will appreciate that the although text is used to indicate the contents of the IE in Figure 8A, in an actual implementation the text would be replaced by appropriately coded information.

[0055] In some embodiments, the IEs for all packets that are transmitted with the same modulation and coding schemes (MCS) are grouped together for efficiency. Figure 8B is a block diagram of a block 850 of IEs that are grouped by MCS. A frame control header (FCH) 855 or other control message is transmitted prior to the block to indicate the length and the MCS used for each segment of the block. In some embodiments, adaptive modulation and coding (AMC) is used for the transmission of the IE's. A special rule, which is known to both base stations and mobile devices, can be used to determine the IE MCS, based on the MCS of its corresponding packet for proper reception of the IE. In some embodiments, the MCS for an IE is maintained the same as that of its corresponding application packet. In some embodiments, the MCS for an IE is one level more conservative than that of its corresponding packet. For example, if the MCSI for a packet is 2 (QPSK with rate- $\frac{1}{2}$ coding), then the MCSI for its IE is 3 (QPSK with rate- $\frac{1}{4}$ coding).

V. Voice Activity Detection

[0056] Typical voice conversations contain approximately 50 percent silence. In order to take advantage of the fact that about half of the time data does not need to be transmitted at the same rate as when a user is speaking, the system may rely upon detecting the period of silence and reducing the effective data transfer rate during that period. The silence period in conversation is detected by a vocoder using technologies such as Voice Activity Detection (VAD). Voice packets are only generated when voice activity is detected. During the silence period, the voice packet data rate is greatly reduced.

[0057] In addition to reducing the voice packet data rate during periods of silence, the bandwidth allocation for the voice connection may also be reduced. The MAC scheduler at the base station may use the indication of voice activity to adjust the bandwidth allocation for the voice connection. In the uplink direction, the mobile device sends a special MAC message once a VAD indication is received from its vocoder. The MAC message indicates to the base station that the voice data rate is being temporarily reduced. When such an indication is received, the MAC scheduler can reduce the airlink resource allocated to the voice connection. Similarly, if the VAD indicates new voice activity, the mobile device notifies the base station using a MAC message and the original resource allocation is re-applied to the voice connection.

[0058] In the downlink direction, if there is no voice packet to be transmitted over a voice connection, the MAC scheduler allocates the resource to other voice connections. As a consequence, a resource block previous allocated for the connection in a particular zone may become vacant. Several methods can be used to deal with such fragmentation in the zone.

[0059] In some embodiments, the MAC scheduler at the base station reallocates the resource with the objective of minimizing the impact to other voice connections, such as their adaptive modulation and coding processes.

[0060] In some embodiments, the MAC scheduler maintains the resource allocation of the other voice connections, and allocates the resource vacated by the silent voice connection to new voice connections or other application packets.

[0061] In some embodiments, the MAC scheduler moves all the subsequent allocations up to fill the resource gap. As shown in Figure 10A, once a voice connection, identified by VCID 2 enters a silent period, the other voice connections are moved by the MAC scheduler to occupy the resource vacated by VCID 2.

[0062] In some embodiments, the MAC scheduler uses the last voice time-frequency resource in the same zone to fill the resource gap of a silent voice connection. Figure 10B illustrates such a case, when the MAC scheduler moves the last voice connection VCID 12 to occupy the resource allocation gap that is vacated by the voice connection VCID 2.

[0063] In some embodiments, the MAC scheduler uses the last voice time-frequency resource that has the same coding and modulation scheme, and is contained in the same zone, to fill the resource gap. The resource gap that is introduced by such a replacement is then filled by the voice time-frequency resource that is subsequent to the voice time-frequency resource that was moved. As shown in Figure 10C, voice connection VCID 6 uses the same coding and modulation scheme as voice connection VCID 2, and is the last connection having that scheme in the zone. When voice connection VCID 2 goes into a silent period, the MAC scheduler allocates the voice connection VCID 2 resource to voice connection VCID 6. The MAC scheduler then moves resources after voice connection VCID 6, specifically VCID 7 in Figure 10C, to occupy the resource allocation gap that is caused by moving voice connection VCID 6.

[0064] The above detailed description of embodiments of the system is not intended to be exhaustive or to limit the system to the precise form disclosed above. While specific embodiments of, and examples for, the system are described above for illustrative purposes, various equivalent modifications are possible within the scope of the system, as those skilled in the relevant art will recognize. For example, while processes are presented in a given order, alternative embodiments may perform routines having steps in a different order, and some processes may be deleted, moved, added, subdivided, combined, and/or modified to provide alternative or subcombinations. Each of these

processes may be implemented in a variety of different ways. Further any specific numbers noted herein are only examples: alternative implementations may employ differing values or ranges.

[0065] These and other changes can be made to the invention in light of the above Detailed Description. While the above description describes certain embodiments of the technology, and describes the best mode contemplated, no matter how detailed the above appears in text, the invention can be practiced in many ways. Details of the system may vary considerably in its implementation details, while still being encompassed by the technology disclosed herein. As noted above, particular terminology used when describing certain features or aspects of the technology should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the technology with which that terminology is associated. In general, the terms used in the following claims should not be construed to limit the invention to the specific embodiments disclosed in the specification, unless the above Detailed Description section explicitly defines such terms. Accordingly, the actual scope of the invention encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the invention under the claims.

CLAIMS

We claim:

1. A method for a base station in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the method comprising:

designating a first zone of time-frequency resource in a cell for transmission of packets associated with a voice application, the first zone selected to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application;

allocating N basic time-frequency resource units in the first zone for transmission of a packet associated with the voice application to a mobile device, wherein a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols and N is an integer number; and

transmitting a signal carrying the packet to a mobile device over the N basic time-frequency units in the first zone.

2. The method of claim 1, wherein the packet contains data associated with a real time protocol (RTP).

3. The method of claim 2, wherein the data is identified for transmission in the first zone based on a RTP header associated with the data.

4. The method of claim 1, wherein the packet contains data associated with a user datagram protocol (UDP).

5. The method of claim 1, wherein the packet contains data associated with a session initiation protocol (SIP).

6. The method of claim 1, wherein data contained in the packet is identified for transmission in the first zone based on a quality of service requirement.

7. The method of claim 1, further comprising sending information to the mobile device to indicate the allocation of the N basic time-frequency resource units used for the transmission of the packet.

8. A method for a mobile device in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the method comprising:

receiving at the mobile device, from a base station, information indicating an allocation of N basic time-frequency resource units in a first zone of time-frequency resource designated for transmission from a current cell, to the base station, of packets associated with a voice application, wherein:

the first zone is selected by the base station to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application;

a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols; and

N is an integer number; and

transmitting, to the base station, a signal carrying a packet over the N basic time-frequency units in the first zone.

9. The method of claim 8, wherein the packet contains data generated from a voice source coder (vocoder).

10. The method of claim 8, further comprising receiving, from the base station, information indicating a modulation and coding scheme for the transmission of the packets associated with the voice application.

11. The method of claim 8, further comprising receiving, from the base station, information indicating transmission power control information for the transmission of the packets associated with the voice application.

12. A base station in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the base station comprising:

- a controller configured to designate a first zone of time-frequency resource in a cell for transmission of packets associated with a voice application, the first zone selected to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application;
- a scheduler configured to allocate N basic time-frequency resource units in the first zone for transmission of a packet associated with the voice application to a mobile device, wherein a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols and N is an integer number; and
- a transmitter configured to transmit a signal carrying the packet to a mobile device over the N basic time-frequency units in the first zone.

METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH
REDUCED OVERHEAD

ABSTRACT

A method and system for minimizing the control overhead in a multi-carrier wireless communication network that utilizes a time-frequency resource is disclosed. In some embodiments, one or more zones in the time-frequency resource are designated for particular applications, such as a zone dedicated for voice-over-IP (VoIP) applications. By grouping applications of a similar type together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a portion of the time-frequency resource can be achieved. In some embodiments, modular coding schemes associated with the packet streams may be selected that further reduce the amount of necessary control information. In some embodiments, packets may be classified for transmission in accordance with application type, QoS parameters, and other properties. In some embodiments, improved control messages may be constructed to facilitate the control process and minimize associated overhead.

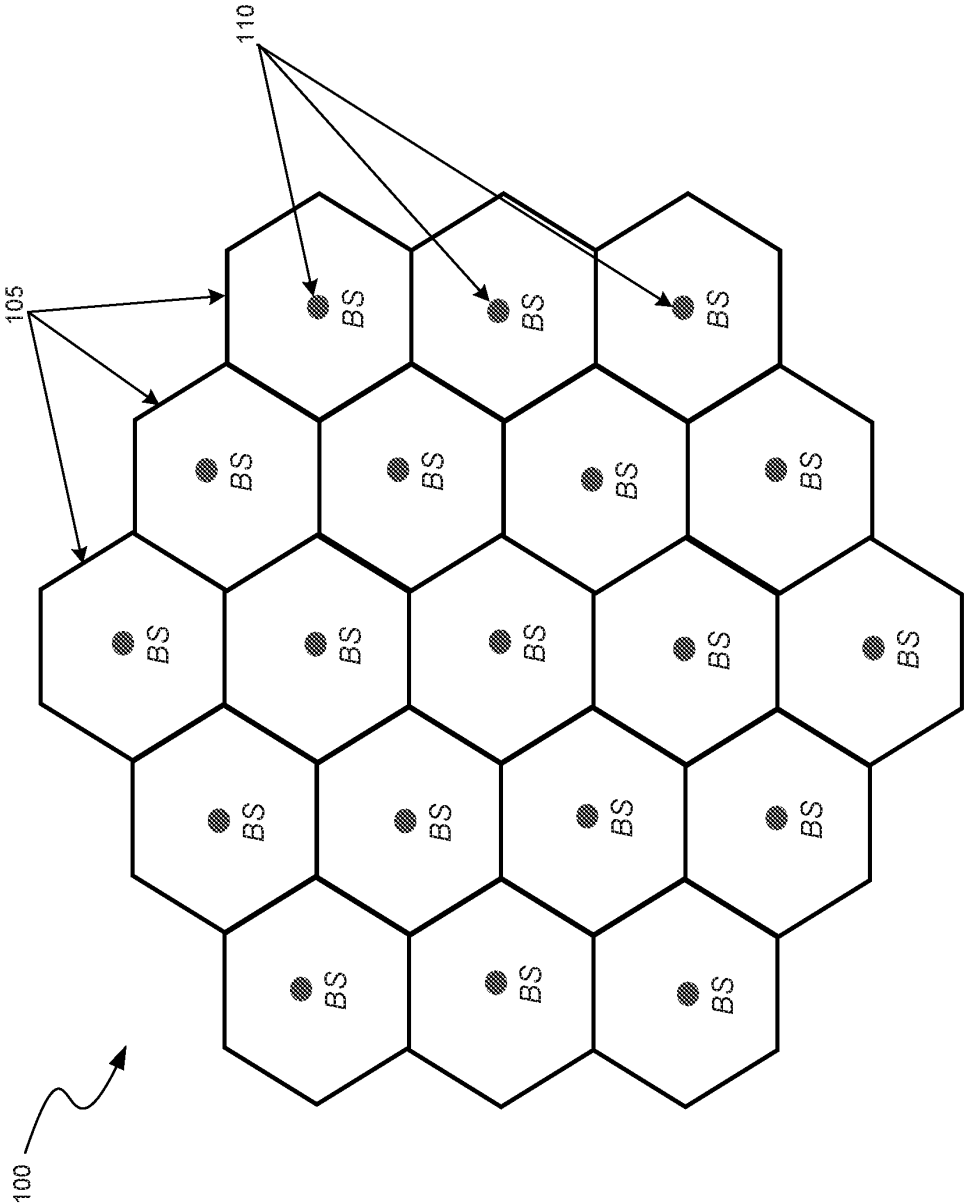


FIG. 1

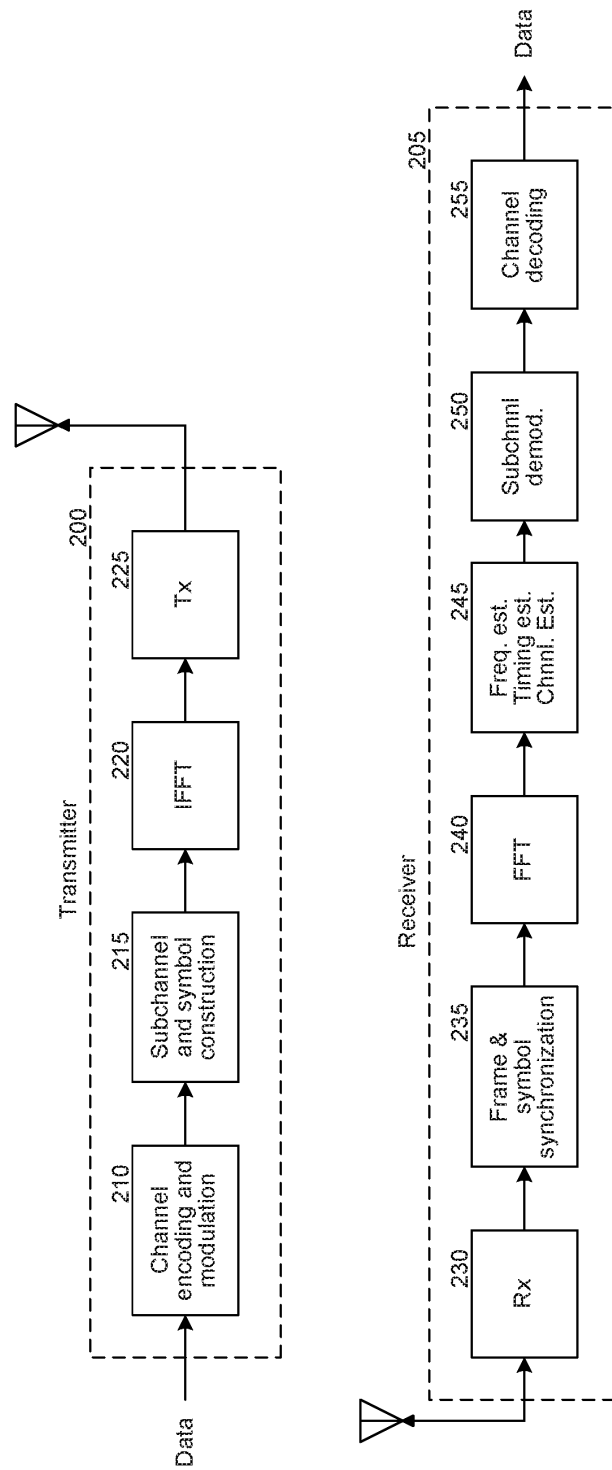


FIG. 2

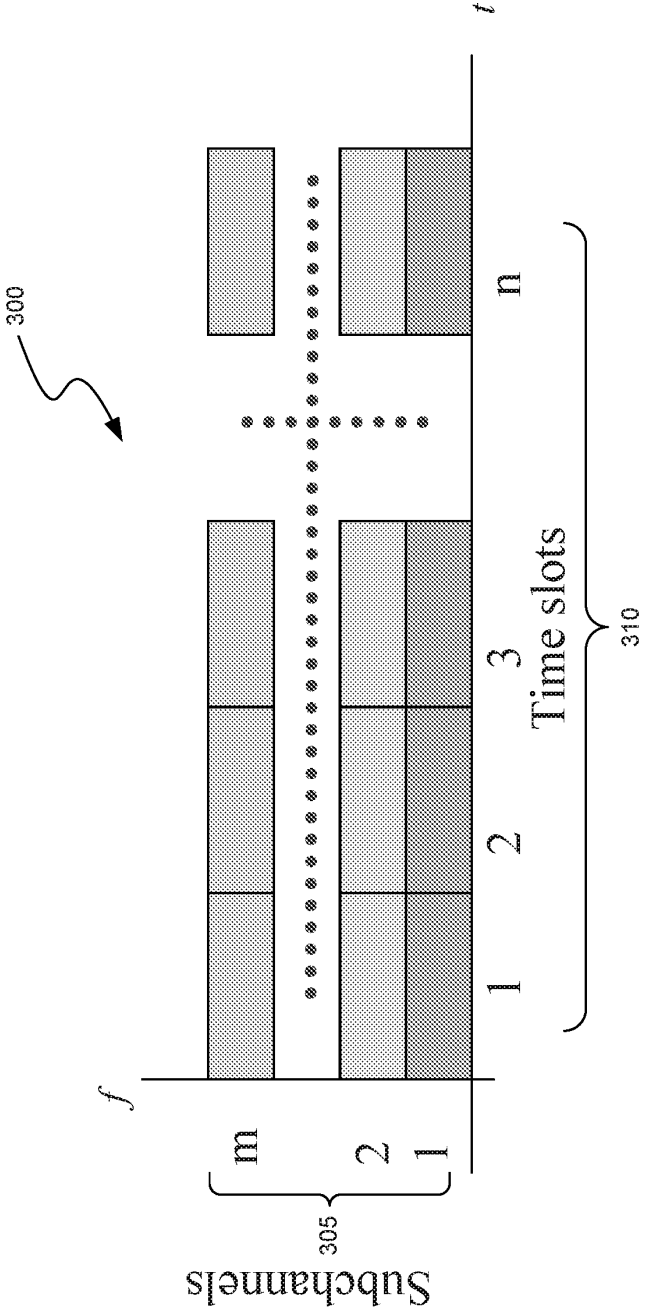


FIG. 3

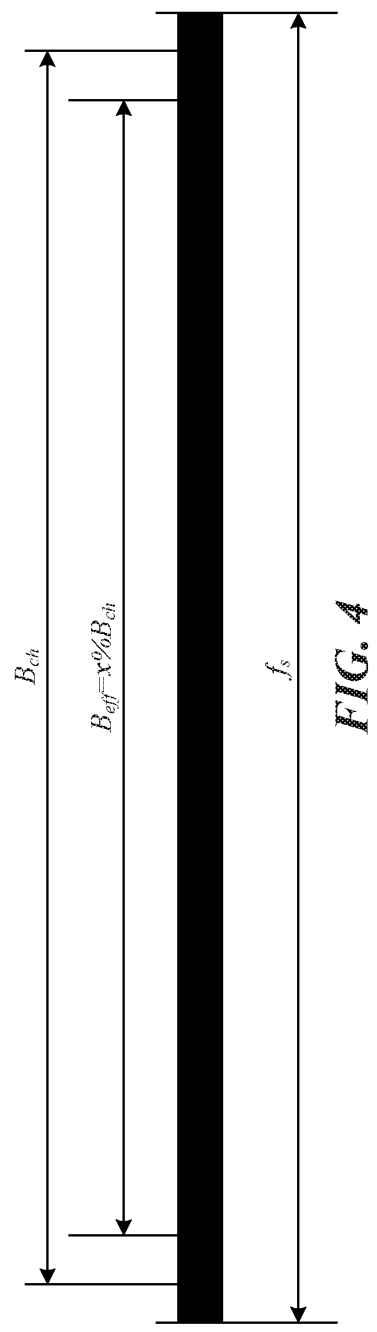
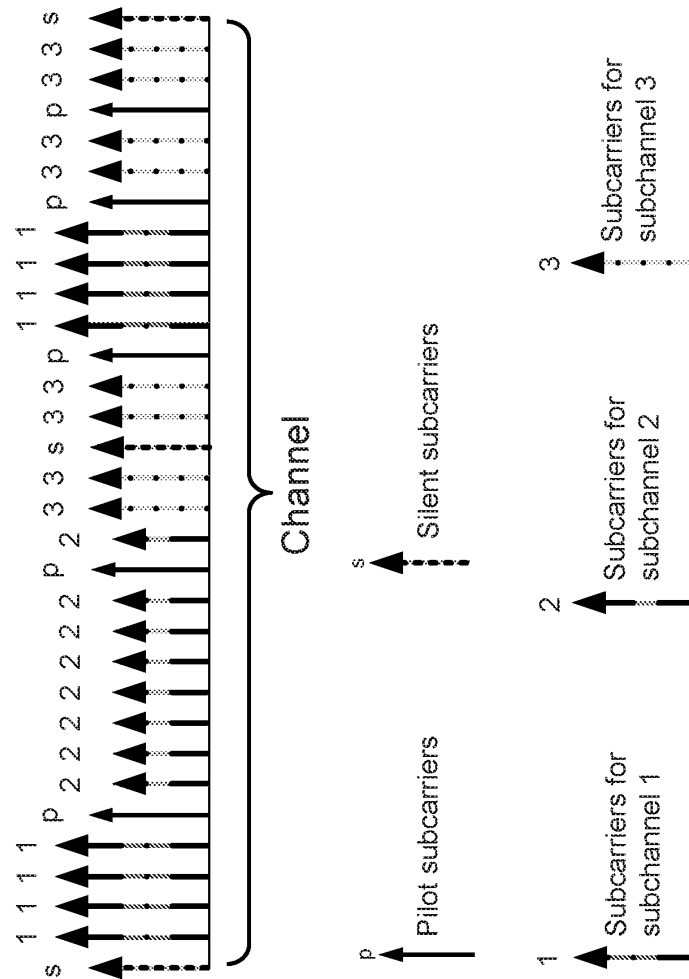


FIG. 4



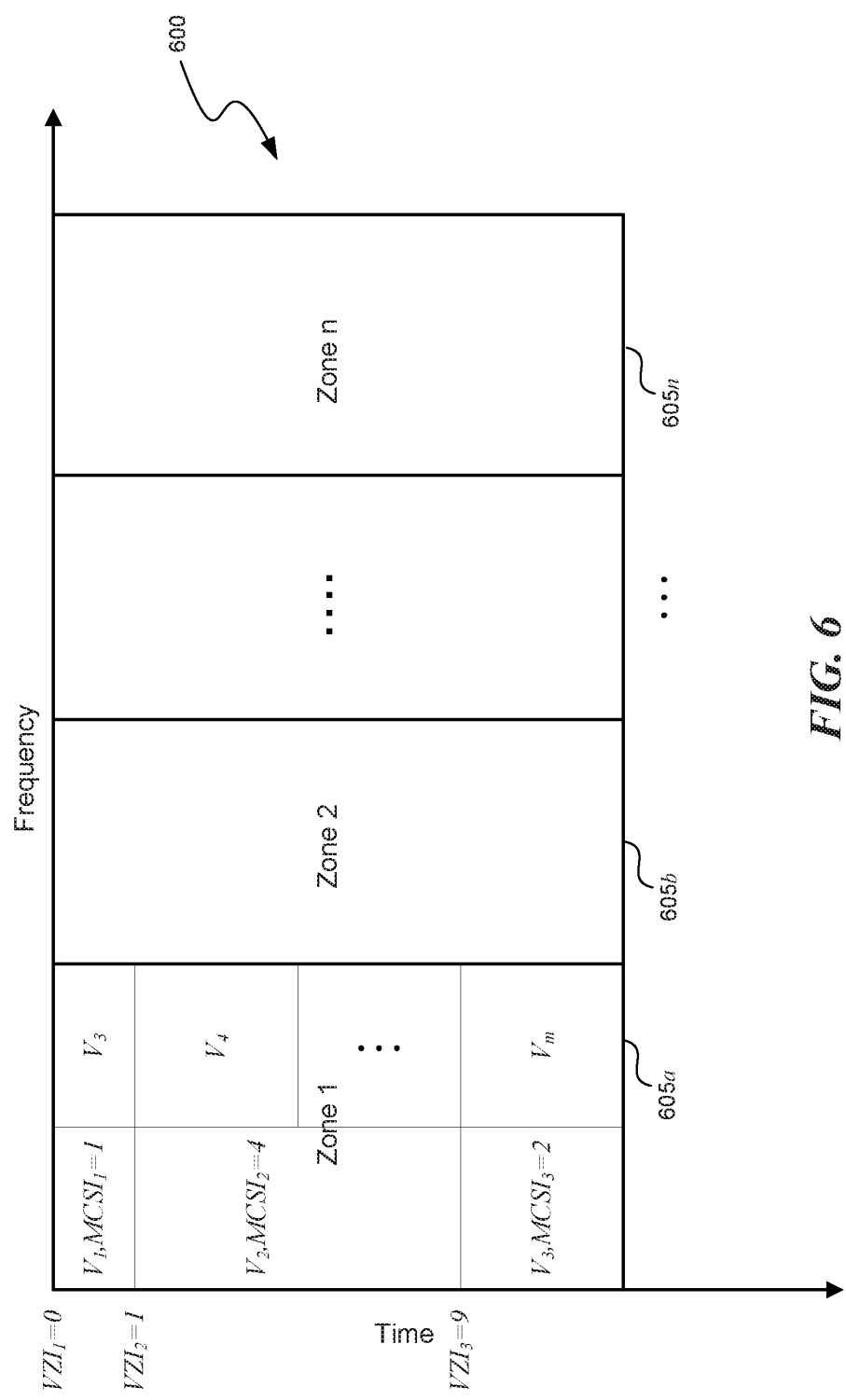


FIG. 6

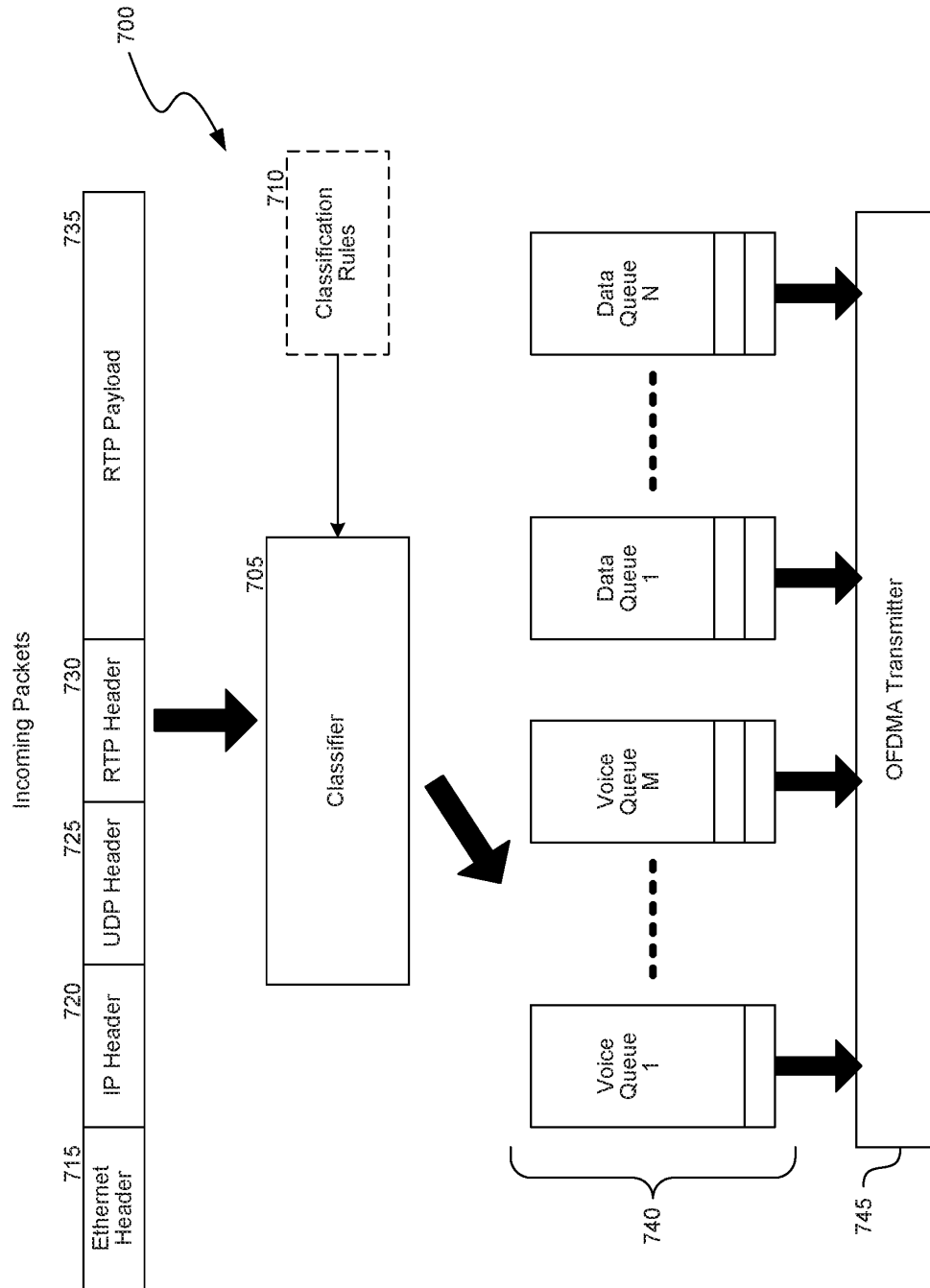


FIG. 7

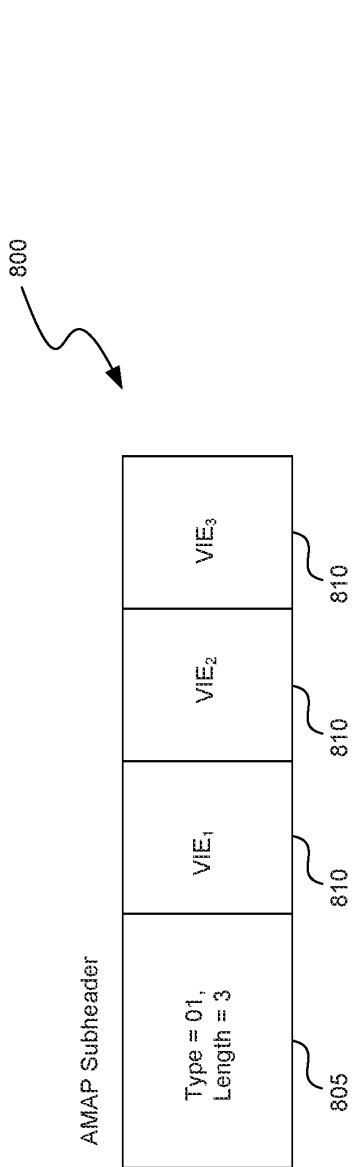


FIG. 8A

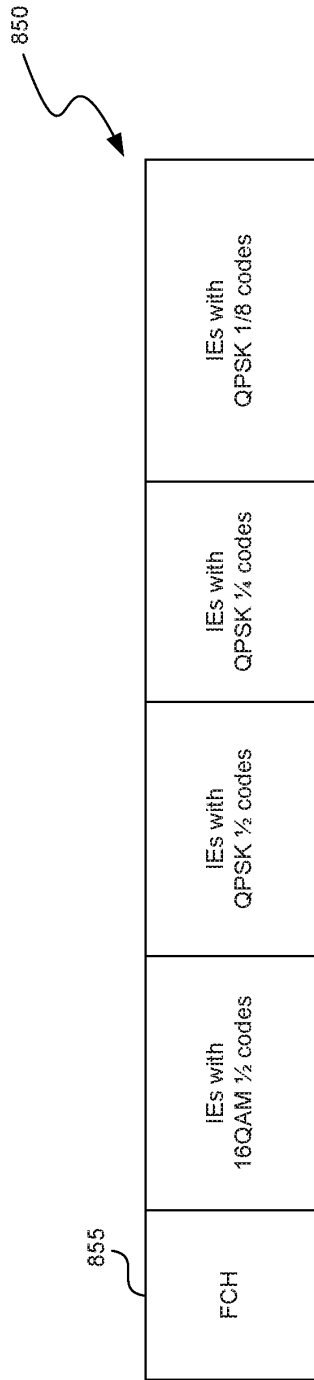
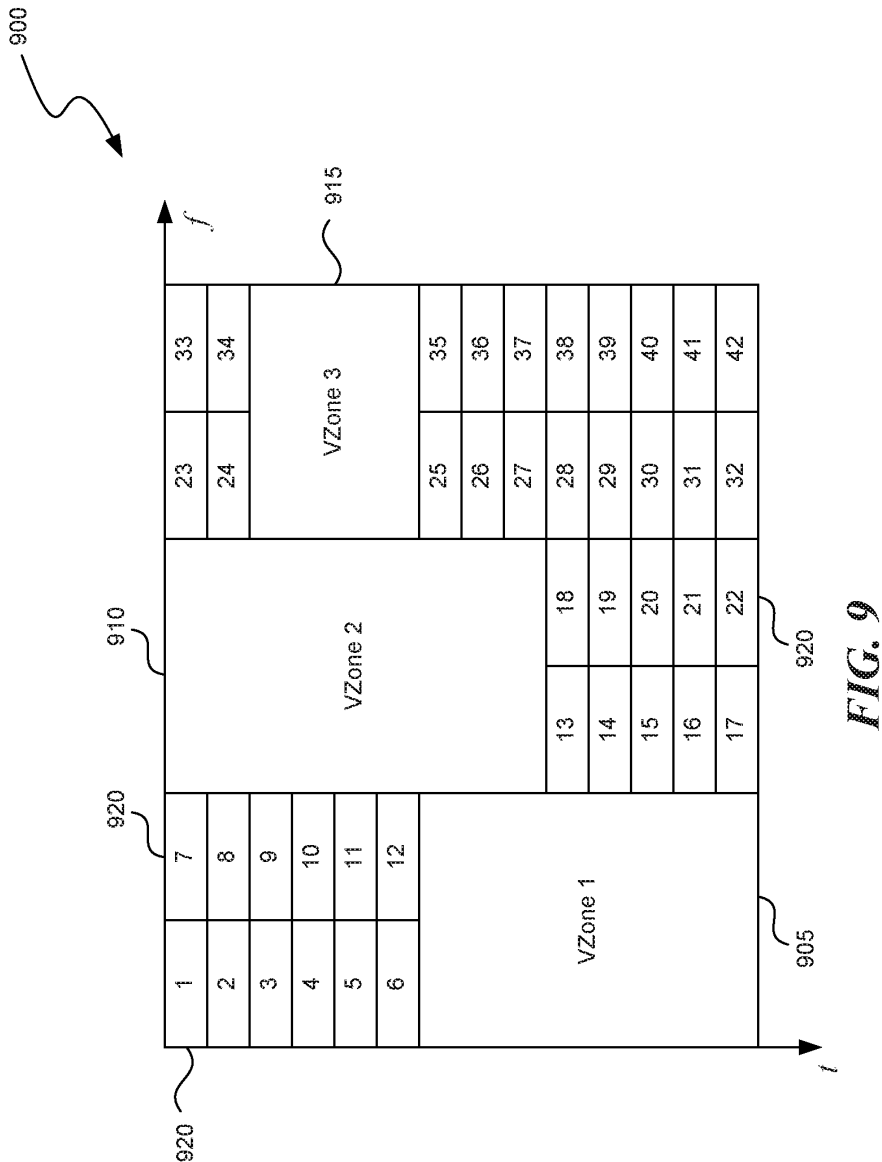


FIG. 8B



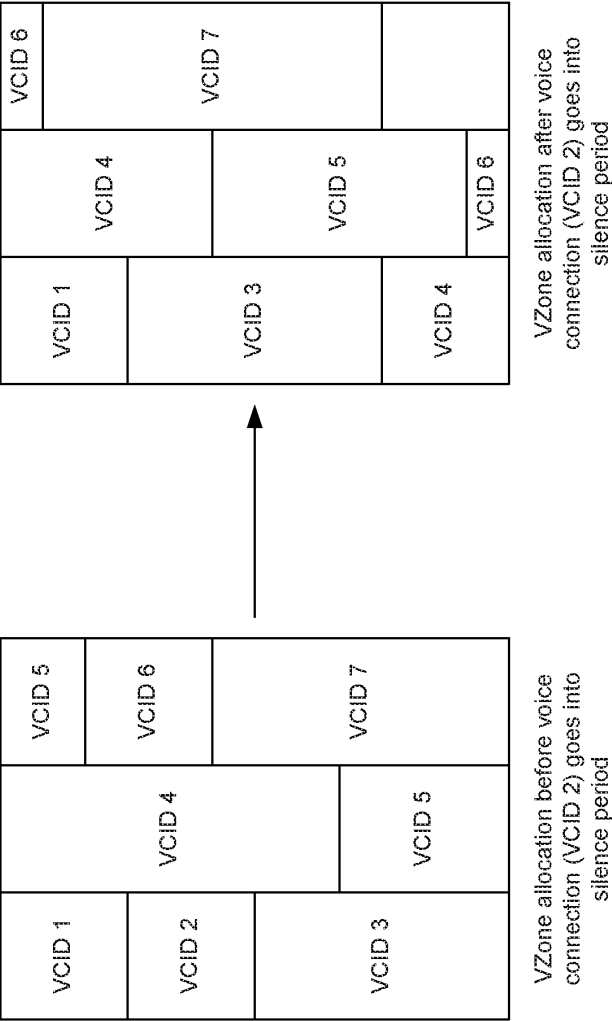


FIG. 10A

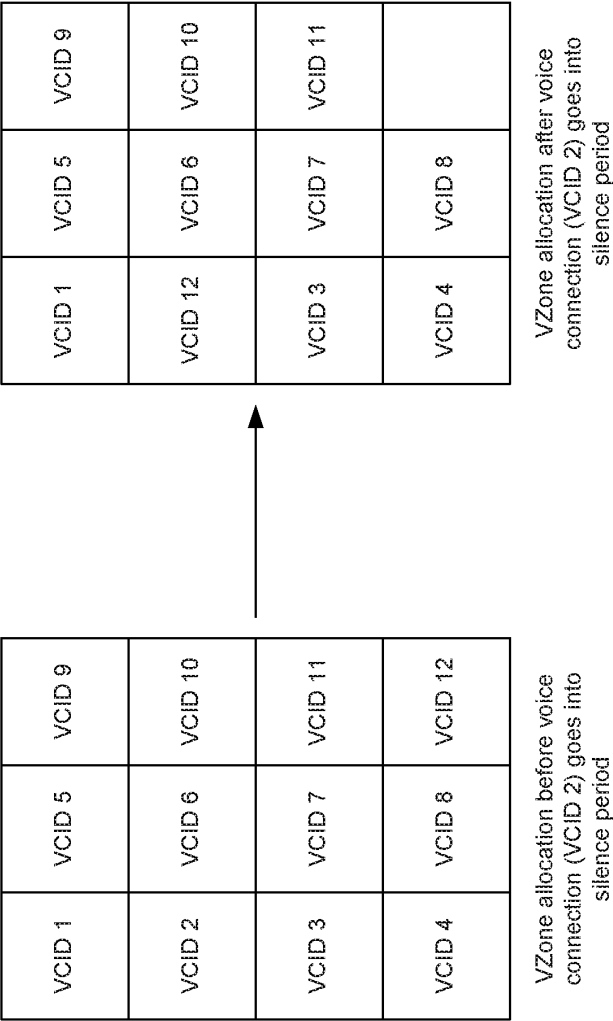


FIG. 10B

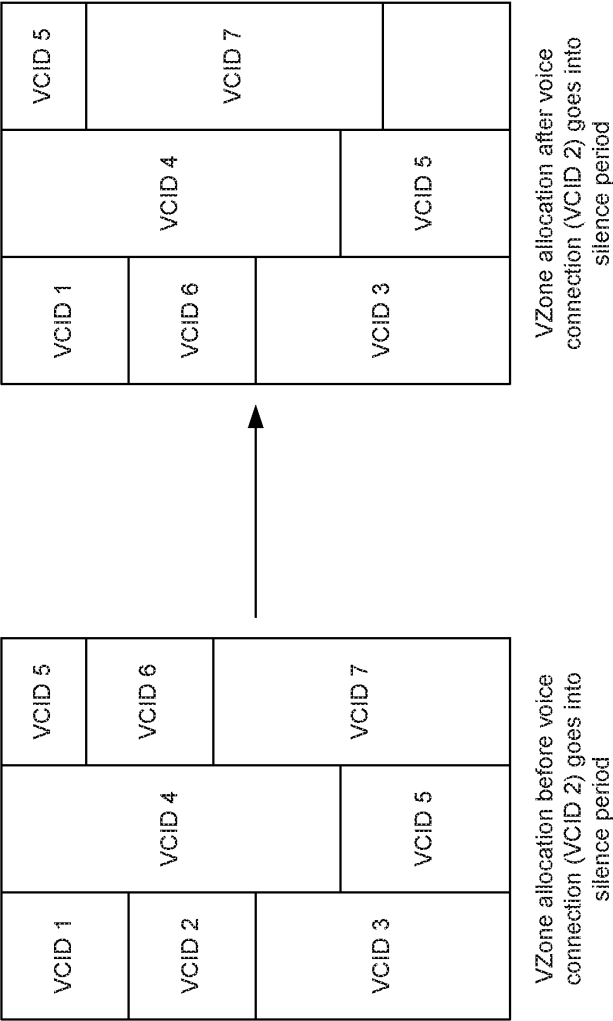


FIG. 10C

Electronic Acknowledgement Receipt	
EFS ID:	30072632
Application Number:	15676421
International Application Number:	
Confirmation Number:	8295
Title of Invention:	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
First Named Inventor/Applicant Name:	Xiaodong Li
Customer Number:	25096
Filer:	Stephen C Bishop/Todd Nielsen
Filer Authorized By:	Stephen C Bishop
Attorney Docket Number:	061240-8017.US06
Receipt Date:	14-AUG-2017
Filing Date:	
Time Stamp:	16:25:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	0612408017US06_ADS_08_14_17.PDF	1823657	no	10
			d5ae9e7d51cde1a27c050e1246c8c4ed69bb6152		

Warnings:

Information:					
2		0612408017US06_Application_08_14_17.pdf	1957007 ab16e30b02c86a9365aa0e844484861632f6abd8	yes	43
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal of New Application		1	1	
	Power of Attorney		2	2	
	Assignee showing of ownership per 37 CFR 3.73		3	4	
	Oath or Declaration filed		5	8	
	Specification		9	27	
	Claims		28	30	
	Abstract		31	31	
	Drawings-only black and white line drawings		32	43	
Warnings:					
Information:					
Total Files Size (in bytes):			3780664		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Xiaodong		Li			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Kirkland	State/Province	WA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	1750 112th Ave. NE					
Address 2	Suite D159					
City	Bellevue	State/Province	WA			
Postal Code	98004	Country	US			
Inventor	2				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Haiming		Huang			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Bellevue	State/Province	WA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	1750 112th Ave. NE					
Address 2	Suite D159					
City	Bellevue	State/Province	WA			
Postal Code	98004	Country	US			
Inventor	3				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Titus		Lo			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

City	Bellevue	State/Province	WA	Country of Residence	US
------	----------	----------------	----	----------------------	----

Mailing Address of Inventor:

Address 1	1750 112th Ave. NE				
Address 2	Suite D159				
City	Bellevue	State/Province	WA		
Postal Code	98004	Country i	US		
Inventor	4				Remove
Legal Name					

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ruifeng		Wang	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Sammamish	State/Province	WA	Country of Residence	US
------	-----------	----------------	----	----------------------	----

Mailing Address of Inventor:

Address 1	1750 112th Ave. NE				
Address 2	Suite D159				
City	Bellevue	State/Province	WA		
Postal Code	98004	Country i	US		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.**Correspondence Information:**Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).☐ An Address is being provided for the correspondence Information of this application.

Customer Number	25096		
Email Address	patentprocurement@perkinscoie.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
Attorney Docket Number	061240-8017.US06	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	12	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	25096		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	14720554	2015-05-22

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		061240-8017.US06	
		Application Number			
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD				

Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14720554	Continuation of	14248243	2014-04-08	9042337	2015-05-26
Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14248243	Continuation of	13115055	2011-05-24	8693430	2014-04-08
Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13115055	Continuation of	11908257	2008-07-14	7948944	2011-05-24
Prior Application Status		Expired		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11908257	a 371 of international	PCTUS0638149	2006-09-28		
Prior Application Status		Expired		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
PCTUS0638149	Claims benefit of provisional	60721451	2005-09-28		
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.					

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number		Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove
Additional Foreign Priority Data may be generated within this form by selecting the Add button.					Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1		Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
☐ Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Neocific, Inc.		
Mailing Address Information For Applicant:			
Address 1	1750 112th Ave. NE		
Address 2	Suite D159		
City	Bellevue	State/Province	WA
Country	US	Postal Code	98004
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Stephen Bishop/		Date (YYYY-MM-DD)	2017-08-14
First Name	Stephen	Last Name	Bishop	Registration Number
				38829
Additional Signature may be generated within this form by selecting the Add button.				Add

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017.US06
		Application Number	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

SCORE Placeholder Sheet for IFW Content

Application Number: 15676421

Document Date: 08/14/2017

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

- Drawings – Other than Black and White Line Drawings

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

To access the documents in the SCORE database, refer to instructions below.

At the time of document entry (noted above):

- Examiners may access SCORE content via the eDAN interface.
- Other USPTO employees can bookmark the current SCORE URL (<http://Score.uspto.gov/ScoreAccessWeb/>).
- External customers may access SCORE content via the Public and Private PAIR interfaces.

PATENT APPLICATION FEE DETERMINATION RECORD						Application or Docket Number 15/676,421	
Substitute for Form PTO-875							
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	300		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	12	minus 20 = *	x 40 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 210 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	730		TOTAL	
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x	=	OR
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x	=	OR
	Application Size Fee (37 CFR 1.16(s))						OR
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR
TOTAL ADD'L FEE					OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x	=	OR
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x	=	OR
	Application Size Fee (37 CFR 1.16(s))						OR
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR
TOTAL ADD'L FEE					OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
15/676,421	08/14/2017		0.00	061240-8017.US06	12	3

CONFIRMATION NO. 8295

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

FILING RECEIPT



000000093573283

Date Mailed: 08/22/2017

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Xiaodong Li, Kirkland, WA;
Haiming Huang, Bellevue, WA;
Titus Lo, Bellevue, WA;
Ruifeng Wang, Sammamish, WA;

Applicant(s)

Neocific, Inc., Bellevue, WA;

Power of Attorney: The patent practitioners associated with Customer Number 25096

Domestic Priority data as claimed by applicant

This application is a CON of 14/720,554 05/22/2015 PAT 9735944
which is a CON of 14/248,243 04/08/2014 PAT 9042337
which is a CON of 13/115,055 05/24/2011 PAT 8693430
which is a CON of 11/908,257 07/14/2008 PAT 7948944
which is a 371 of PCT/US06/38149 09/28/2006
which claims benefit of 60/721,451 09/28/2005

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/18/2017

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/676,421**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06

CONFIRMATION NO. 8295

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

FORMALITIES LETTER



Date Mailed: 08/22/2017

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.

The surcharge is due for any one of:

- late submission of the basic filing fee, search fee, or examination fee,
- late submission of inventor's oath or declaration,
- filing an application that does not contain at least one claim on filing, or
- submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **70** basic filing fee.
- \$ **70** surcharge.
- \$ **300** search fee.
- \$ **360** examination fee.
- \$(**0**) previous unapplied payment amount.
- \$ **800** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/mbeyene/

Docket No.: 061240-8017.US06
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Li et al.

Application No.: 15/676,421

Confirmation No.: 8295

Filed: August 14, 2017

Art Unit: Not Yet Assigned

For: METHOD AND SYSTEM FOR MULTI-
CARRIER PACKET COMMUNICATION
WITH REDUCED OVERHEAD

Examiner: Not Yet Assigned

RESPONSE TO NOTICE TO FILE MISSING PARTS OF APPLICATION

MS Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Notice to File Missing Parts of Application – Filing Date Granted mailed August 22, 2017, Applicant respectfully submits the Filing Fee for the Application (as shown on accompanying Fee Transmittal), a Petition for Extension of Time, and a General Authorization for Extensions of Time under 37 C.F.R. § 1.136(A)(3) and Fees under 37 C.F.R. § 1.17.

Application No.: 15/676,421

Docket No.: 061240-8017.US06

Payment by Credit Card is submitted herewith in the amount of \$2,365 covering the fees set forth in 37 C.F.R. § 1.16(f), 1.16(a), 1.16(k), 1.16(o), and 1.17(a)(5). The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 50-0665, under Order No. 061240-8017.US06.

Dated: 19 March 2018

Respectfully submitted,

By /Stephen Bishop/

Stephen Bishop

Registration No.: 38,829

PERKINS COIE LLP

P.O. Box 1247

Seattle, Washington 98111-1247

(206) 359-8000

(206) 359-7198 (Fax)

Attorney for Applicant

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

FEE TRANSMITTAL		Complete if known	
		Application Number	15/676,421
		Filing Date	August 14, 2017
☒ Applicant asserts small entity status. See 37 CFR 1.27.		First Named Inventor	Xiaodong Li
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.		Examiner Name	Not Yet Assigned
		Art Unit	Not Yet Assigned
TOTAL AMOUNT OF PAYMENT	(\$)	Practitioner Docket No.	061240-8017.US06
	2,365		

METHOD OF PAYMENT (check all that apply)
☐ Check ☒ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 50-0665 Deposit Account Name: Perkins Cole LLP

For the above-identified deposit account, the Director is hereby authorized to (check all that apply):

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**
☒ Charge any additional fee(s) or underpayment of fee(s) ☒ Credit any overpayment of fee(s)
under 37 CFR 1.16 and 1.17
WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**FEE CALCULATION****1. BASIC FILING, SEARCH, AND EXAMINATION FEES** (U = undiscounted fee; S = small entity fee; M = micro entity fee)

Application Type	FILING FEES			SEARCH FEES			EXAMINATION FEES			Fees Paid (\$)
	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	
Utility	300	150*	75	660	330	165	760	380	190	785
Design	200	100	50	160	80	40	600	300	150	
Plant	200	100	50	420	210	105	620	310	155	
Reissue	300	150	75	660	330	165	2,200	1,100	550	
Provisional	280	140	70	0	0	0	0	0	0	

* The \$150 small entity status filing fee for a utility application is further reduced to \$75 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	Undiscounted Fee (\$)	Small Entity Fee (\$)	Micro Entity Fee (\$)
Each claim over 20 (including Reissues)	100	50	25
Each independent claim over 3 (including Reissues)	460	230	115
Multiple dependent claims	820	410	205
Total Claims	Extra Claims	Fee (\$)	Fee Paid (\$)
12	-20 or HP =	x	=
HP = highest number of total claims paid for, if greater than 20.			
Indep. Claims	Extra Claims	Fee (\$)	Fee Paid (\$)
3	-3 or HP =	x	=
HP = highest number of independent claims paid for, if greater than 3.			

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$400 (\$200 for small entity) (\$100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fee Paid (\$)
35	- 100 =	/ 50 =	(round up to a whole number) x	=

4. OTHER FEE(S)

Non-English specification, \$130 fee (no small or micro entity discount)

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, \$400 fee (\$200 small or micro entity)

Other (e.g., late filing surcharge): Surcharge - Late filing fee (\$80) and Petition for Extension of Time - 5 mo (\$1,500) \$1,580

SUBMITTED BY

Signature	/Stephen Bishop/	Registration No. (Attorney/Agent)	38,829	Telephone	(206) 359-8000
Name (Print/Type)	Stephen Bishop	Date	19 March 2018		

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)		Docket Number (Optional) 061240-8017.US06
Application Number 15/676,421	Filed August 14, 2017	
For METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
Art Unit Not Yet Assigned	Examiner Not Yet Assigned	
This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.		
The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):		
	<u>Fee</u>	<u>Small Entity Fee</u>
☐ One month (37 CFR 1.17(a)(1))	\$200	\$100
☐ Two months (37 CFR 1.17(a)(2))	\$600	\$300
☐ Three months (37 CFR 1.17(a)(3))	\$1,400	\$700
☐ Four months (37 CFR 1.17(a)(4))	\$2,200	\$1,100
☒ Five months (37 CFR 1.17(a)(5))	\$3,000	\$1,500
☒ Applicant asserts small entity status. See 37 CFR 1.27. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously. ☐ A check in the amount of the fee is enclosed. ☒ Payment by credit card. ☐ The Director has already been authorized to charge fees in this application to a Deposit Account. ☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number <u>50-0665</u> ☐ Payment made via EFS-Web.		
WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. I am the ☐ applicant. ☒ attorney or agent of record. Registration number <u>38,829</u> ☐ attorney or agent acting under 37 CFR 1.34. Registration number _____		
<u>/Stephen Bishop/</u> Stephen Bishop Typed or printed name	<u>19 March 2018</u> <u>(206) 359-8000</u> Date Telephone Number	

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 422 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Li et al.

Application No.: 15/676,421

Confirmation No.: 8295

Filed: August 14, 2017

Art Unit: Not Yet Assigned

For: METHOD AND SYSTEM FOR MULTI-CARRIER
PACKET COMMUNICATION WITH REDUCED
OVERHEAD

Examiner: Not Yet Assigned

**AUTHORIZATION FOR: EXTENSIONS OF TIME UNDER 37 C.F.R. § 1.136(A)(3) AND FEES UNDER
37 C.F.R. § 1.17**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

With respect to the above-identified application, the Commissioner is authorized to treat any concurrent or future reply requiring a petition for an extension of time under 37 C.F.R. § 1.136(a)(3) for its timely submission as incorporating a petition therefor for the appropriate length of time.

The Commissioner is also authorized to charge any extension of time fees or other fees that may be required under 37 C.F.R. § 1.17 for any paper filed concurrently herewith or in the future, or credit any overpayment, to Deposit Account No. 50-0665.

Dated: 19 March 2018

Respectfully submitted,

By /Stephen Bishop/
Stephen Bishop
Registration No.: 38,829
PERKINS COIE LLP
P.O. Box 1247
Seattle, Washington 98111-1247
(206) 359-8000
(206) 359-7198 (Fax)
Attorney for Applicant

Electronic Patent Application Fee Transmittal				
Application Number:		15676421		
Filing Date:		14-Aug-2017		
Title of Invention:		METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
First Named Inventor/Applicant Name:		Xiaodong Li		
Filer:		Stephen C Bishop/Todd Nielsen		
Attorney Docket Number:		061240-8017.US06		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	80	80
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 5 months with \$0 paid	2255	1	1500	1500
Miscellaneous:				
Total in USD (\$)				2365

Electronic Acknowledgement Receipt	
EFS ID:	32097590
Application Number:	15676421
International Application Number:	
Confirmation Number:	8295
Title of Invention:	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
First Named Inventor/Applicant Name:	Xiaodong Li
Customer Number:	25096
Filer:	Stephen C Bishop/Todd Nielsen
Filer Authorized By:	Stephen C Bishop
Attorney Docket Number:	061240-8017.US06
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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0612408017US06_MP_Response_03_19_18.pdf	372078	yes	5
			18bcd913edfbc346a71300c2d0200a99eeeb23b37		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Applicant Response to Pre-Exam Formalities Notice		1	2	
	Transmittal Letter		3	3	
	Extension of Time		4	4	
	Authorization for Extension of Time all replies		5	5	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	39094	no	2
			20f1f18a57c651b67a34cdca9512f595d73bb211		
Warnings:					
Information:					
Total Files Size (in bytes):			411172		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
15/676,421	08/14/2017		865	061240-8017.US06	12	3

CONFIRMATION NO. 8295

UPDATED FILING RECEIPT



25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

Date Mailed: 03/21/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Xiaodong Li, Kirkland, WA;
Haiming Huang, Bellevue, WA;
Titus Lo, Bellevue, WA;
Ruifeng Wang, Sammamish, WA;

Applicant(s)

Neocific, Inc., Bellevue, WA;

Power of Attorney: The patent practitioners associated with Customer Number 25096

Domestic Priority data as claimed by applicant

This application is a CON of 14/720,554 05/22/2015 PAT 9735944
which is a CON of 14/248,243 04/08/2014 PAT 9042337
which is a CON of 13/115,055 05/24/2011 PAT 8693430
which is a CON of 11/908,257 07/14/2008 PAT 7948944
which is a 371 of PCT/US06/38149 09/28/2006
which claims benefit of 60/721,451 09/28/2005

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/18/2017

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/676,421**

Projected Publication Date: 06/28/2018

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 15/676,421	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	12	minus 20 = *	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	
				785			
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06

CONFIRMATION NO. 8295

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

PUBLICATION NOTICE



OC000000100625111

Title:METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

Publication No.US-2018-0183558-A1

Publication Date:06/28/2018

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publicly available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PLUS Search Results for S/N 15676421, Searched Mon Aug 06 10:18:29 EDT 2018

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

4224990 99
3555194 73
3558823 73
3558827 73
3558916 73
3560654 73
3566026 73
3566044 73
3590150 73
3590156 73
3607310 73
3646520 73
3702076 73
3715465 73
3776604 73
3819234 73
4213331 73
4970537 73



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06	8295
25096 7590 11/05/2018 PERKINS COIE LLP - SEA General PATENT-SEA P.O. BOX 1247 SEATTLE, WA 98111-1247			EXAMINER PATEL, CHANDRAHAS B	
			ART UNIT 2464	PAPER NUMBER
			NOTIFICATION DATE 11/05/2018	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentprocurement@perkinscoie.com

DETAILED ACTION

Double Patenting

1. A rejection based on double patenting of the “same invention” type finds its support in the language of 35 U.S.C. 101 which states that “whoever invents or discovers any new and useful process... may obtain a patent therefor...” (Emphasis added). Thus, the term “same invention,” in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the claims that are directed to the same invention so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

2. Claims 1-12 are rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-12 of prior U.S. Patent No. 9,042,337. This is a statutory double patenting rejection.

Present Application	USPN 9,042,337
1. A method for a base station in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the method comprising: designating a first zone of time-frequency resource in a cell for transmission	1. A method for a base station in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the method comprising: designating a first zone of time-frequency resource in a cell for transmission

of packets associated with a voice application, the first zone selected to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application; allocating N basic time-frequency resource units in the first zone for transmission of a packet associated with the voice application to a mobile device, wherein a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols and N is an integer number; and transmitting a signal carrying the packet to a mobile device over the N basic time-frequency units in the first zone.	of packets associated with a voice application, the first zone selected to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application; allocating N basic time-frequency resource units in the first zone for transmission of a packet associated with the voice application to a mobile device, wherein a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols and N is an integer number; and transmitting a signal carrying the packet to a mobile device over the N basic time-frequency units in the first zone.
2. The method of claim 1, wherein the packet contains data associated with a real time protocol (RTP).	2. The method of claim 1, wherein the packet contains data associated with a real time protocol (RTP).
3. The method of claim 2, wherein the data is identified for transmission in the first zone based on a RTP header associated with the data.	3. The method of claim 2, wherein the data is identified for transmission in the first zone based on a RTP header associated with the data.

4. The method of claim 1, wherein the packet contains data associated with a user datagram protocol (UDP).	4. The method of claim 1, wherein the packet contains data associated with a user datagram protocol (UDP).
5. The method of claim 1, wherein the packet contains data associated with a session initiation protocol (SIP).	5. The method of claim 1, wherein the packet contains data associated with a session initiation protocol (SIP).
6. The method of claim 1, wherein data contained in the packet is identified for transmission in the first zone based on a quality of service requirement.	6. The method of claim 1, wherein data contained in the packet is identified for transmission in the first zone based on a quality of service requirement.
7. The method of claim 1, further comprising sending information to the mobile device to indicate the allocation of the N basic time-frequency resource units used for the transmission of the packet.	7. The method of claim 1, further comprising sending information to the mobile device to indicate the allocation of the N basic time-frequency resource units used for the transmission of the packet.
8. A method for a mobile device in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the method comprising: receiving at the mobile device, from a base station, information indicating an	8. A method for a mobile device in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the method comprising: receiving at the mobile device, from a base station, information indicating an

allocation of N basic time-frequency resource units in a first zone of time-frequency resource designated for transmission from a current cell, to the base station, of packets associated with a voice application, wherein: the first zone is selected by the base station to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application; a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols; and N is an integer number; and transmitting, to the base station, a signal carrying a packet over the N basic time-frequency units in the first zone.	allocation of N basic time-frequency resource units in a first zone of time-frequency resource designated for transmission from a current cell, to the base station, of packets associated with a voice application, wherein: the first zone is selected by the base station to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application; a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols; and N is an integer number; and transmitting, to the base station, a signal carrying a packet over the N basic time-frequency units in the first zone.
9. The method of claim 8, wherein the packet contains data generated from a voice source coder (vocoder).	9. The method of claim 8, wherein the packet contains data generated from a voice source coder (vocoder).
10. The method of claim 8, further comprising receiving, from the base station, information indicating a modulation and coding scheme	10. The method of claim 8, further comprising receiving, from the base station, information indicating a modulation and coding scheme

for the transmission of the packets associated with the voice application.	for the transmission of the packets associated with the voice application.
11. The method of claim 8, further comprising receiving, from the base station, information indicating transmission power control information for the transmission of the packets associated with the voice application.	11. The method of claim 8, further comprising receiving, from the base station, information indicating transmission power control information for the transmission of the packets associated with the voice application.
12. A base station in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the base station comprising: a controller configured to designate a first zone of time-frequency resource in a cell for transmission of packets associated with a voice application, the first zone selected to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application; a scheduler configured to allocate N basic time-frequency resource units in the first zone for	12. A base station in a multi-cell wireless packet system using a frame structure, each frame comprising a plurality of time slots, each time slot comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, the base station comprising: a controller configured to designate a first zone of time-frequency resource in a cell for transmission of packets associated with a voice application, the first zone selected to be different from a second zone of time-frequency resource designated in a neighboring cell for transmission of packets associated with the voice application; a scheduler configured to allocate N basic time-frequency resource units in the first zone for

transmission of a packet associated with the voice application to a mobile device, wherein a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols and N is an integer number; and a transmitter configured to transmit a signal carrying the packet to a mobile device over the N basic time-frequency units in the first zone.	transmission of a packet associated with the voice application to a mobile device, wherein a basic time-frequency resource unit contains a number of subcarriers in a number of OFDM symbols and N is an integer number; and a transmitter configured to transmit a signal carrying the packet to a mobile device over the N basic time-frequency units in the first zone.
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Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHANDRAHAS PATEL whose telephone number is (571)270-1211. The examiner can normally be reached on Monday - Thursday 7:30 - 17:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Chandahas B Patel/
Primary Examiner, Art Unit 2464

<i>Search Notes</i> 	Application/Control No. 15/676,421	Applicant(s)/Patent Under Reexamination Li et al.
	Examiner CHANDRAHAS PATEL	Art Unit 2464

CPC - Searched*		
Symbol	Date	Examiner
H04L 5/0053, 1/0003	10/31/2018	CBP
H04J 11/005	10/31/2018	CBP

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST search	10/31/2018	CBP
Inventor search	10/31/2018	CBP

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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Bibliographic Data

Application No: 15/676,421

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged:
Examiner's Signature Initials

Title:

METHOD AND SYSTEM FOR MULTI-CARRIER PACKET
COMMUNICATION WITH REDUCED OVERHEAD

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
08/14/2017	370	2464	061240-8017.US06
RULE			

APPLICANTS

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Haiming Huang Bellevue, WA, UNITED STATES

Titus Lo Bellevue, WA, UNITED STATES

Ruifeng Wang Sammamish, WA, UNITED STATES

CONTINUING DATA

This application is a CON of 14720554 05/22/2015 PAT 9735944

14720554 is a CON of 14248243 04/08/2014 PAT 9042337

14248243 is a CON of 13115055 05/24/2011 PAT 8693430

13115055 is a CON of 11908257 07/14/2008 PAT 7948944

11908257 is a 371 of PCT/US06/38149 09/28/2006

PCT/US06/38149 has PRO of 60721451 09/28/2005

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

08/18/2017

** SMALL ENTITY **

STATE OR COUNTRY

UNITED STATES

ADDRESS

PERKINS COIE LLP - SEA General

PATENT-SEA

P.O. BOX 1247
SEATTLE, WA 98111-1247
UNITED STATES

FILING FEE RECEIVED

\$2,365

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	34	(li and huang and lo and wang).in.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/30 16:00
S2	53020	h04l5/0053.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 10:48
S3	9	S2 and ((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 10:48
S4	4627	h04j11/005.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 10:59
S5	10	S4 and ((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 10:59
S6	25401	h04l1/0003.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 11:03
S7	10	S6 and ((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 11:03
S8	56	((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/10/31 11:13

10/31/2018 1:05:33 PM

C:\Users\cpatel1\Documents\EAST\Workspaces\15\15676421.wsp

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1-12. (Canceled)

13. (New) An operating method for a wireless network comprising at least a base station and a mobile station, the wireless network employing 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 method comprising:

assigning an identifier to the mobile station;

transmitting a signal containing information from the base station to the mobile 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; and

receiving by the mobile station the transmitted signal; and

recovering by the mobile station the information from the received signal based on the starting time-frequency coordinate and N in conjunction with the identifier assigned to the mobile station.

14. (New) The method of claim 13, wherein the starting time-frequency coordinate indicates a starting OFDM symbol of the segment of time-frequency resource.

15. (New) The method of claim 13, wherein the starting time-frequency coordinate indicates a starting subcarrier of the segment of time-frequency resource.

16. (New) The method of claim 13, wherein the starting time-frequency coordinate indicates a starting group of subcarriers of the segment of time-frequency resource.

17. (New) The method of claim 13, wherein modular coding is applied to the time-frequency resource units in the segment of time-frequency resource.

18. (New) The method of claim 17, wherein a repetition coding is further applied to the time-frequency resource units.

19. (New) 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:

receive an identifier from a base station in a cell in which the mobile device is operating; and

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 $N = 2, 4, \text{ or } 8$; and

recover the information from the received signal using the starting time-frequency coordinate and N in conjunction with the received identifier.

20. (New) The mobile device of claim 19, wherein the starting time-frequency coordinate indicates a starting OFDM symbol of the segment of time-frequency resource.

21. (New) The mobile device of claim 19, wherein the starting time-frequency coordinate indicates a starting subcarrier of the segment of time-frequency resource.

22. (New) The mobile device of claim 19, wherein the starting time-frequency coordinate indicates a starting group of subcarriers of the segment of time-frequency resource.

23. (New) The mobile device of claim 19, wherein modular coding is applied to the time-frequency resource units in the segment of time-frequency resource.

24. (New) The mobile device of claim 23, wherein a repetition coding is further applied to the time-frequency resource units.

25. (New) A base station 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 base station configured to:

provide an identifier to a mobile device in the cell;

allocate a segment of time-frequency resource for carrying information to the mobile device, 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 $N = 2, 4, \text{ or } 8$; and
transmit a signal containing the information to the mobile device in a manner that allows the mobile device to recover the information using the starting time-frequency coordinate and N in conjunction with the provided identifier.

26. (New) The base station of claim 25, wherein the starting time-frequency coordinate indicates a starting OFDM symbol of the segment of time-frequency resource.

27. (New) The base station of claim 25, wherein the starting time-frequency coordinate indicates a starting subcarrier of the segment of time-frequency resource.

28. (New) The base station of claim 25, wherein the starting time-frequency coordinate indicates a starting group of subcarriers of the segment of time-frequency resource.

29. (New) The base station of claim 25, wherein modular coding is applied to the time-frequency resource units in the segment of time-frequency resource.

30. (New) The base station of claim 29, wherein a repetition coding is further applied to the time-frequency resource units.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Li et al.

Application No.: 15/676,421

Confirmation No.: 8295

Filed: August 14, 2017

Art Unit: 2464

For: METHOD AND SYSTEM FOR MULTI-
CARRIER PACKET COMMUNICATION
WITH REDUCED OVERHEAD

Examiner: Chandrahas B. Patel

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION UNDER 37 CFR
1.111

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Non-Final Office Action mailed on November 5, 2018, please
amend the above-identified U.S. patent application as follows:

INTRODUCTORY COMMENTS

Amendments to the Claims are reflected in the listing of claims which begins on
page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Electronic Patent Application Fee Transmittal				
Application Number:		15676421		
Filing Date:		14-Aug-2017		
Title of Invention:		METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
First Named Inventor/Applicant Name:		Xiaodong Li		
Filer:		Stephen C Bishop/Todd Nielsen		
Attorney Docket Number:		061240-8017.US06		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 3 months with \$0 paid	2253	1	700	700
Miscellaneous:				
STATUTORY OR TERMINAL DISCLAIMER	2814	1	160	160
Total in USD (\$)				860

Electronic Acknowledgement Receipt	
EFS ID:	35932531
Application Number:	15676421
International Application Number:	
Confirmation Number:	8295
Title of Invention:	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
First Named Inventor/Applicant Name:	Xiaodong Li
Customer Number:	25096
Filer:	Stephen C Bishop/Todd Nielsen
Filer Authorized By:	Stephen C Bishop
Attorney Docket Number:	061240-8017.US06
Receipt Date:	06-MAY-2019
Filing Date:	14-AUG-2017
Time Stamp:	22:10:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$860
RAM confirmation Number	050719INTEFSW22115500
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0612408017US06_OA_Response_TD_05_06_19.pdf	189546	yes	8
			dba421532bc037ece53beceb78b719dbd4a6ef67		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Terminal Disclaimer Filed		8	8	
	Applicant Arguments/Remarks Made in an Amendment		6	7	
	Amendment Copy Claims/Response to Suggested Claims		2	5	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32639	no	2
			3ca589223fb2ef4b6dff1d4e8e2fb4459acaa528		
Warnings:					
Information:					
Total Files Size (in bytes):			222185		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING
REJECTION OVER A "PRIOR" PATENT**

Docket Number (Optional)

061240-8017.US06

In re Application of: Li et al.

Application No.: 15/676,421

Filed: August 14, 2017

For: METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

The applicant, Neocific, Inc., owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 9,042,337 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

I hereby acknowledge that any willful false statements made are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 38,829

/Stephen Bishop/

Signature

6 May 2019

Date

Stephen Bishop

Typed or printed name

Attorney for Applicant

Title

(206) 359-8000

Telephone Number

- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

REMARKS

Based on the following remarks, the applicant respectfully requests that the rejections set forth in the Office Action mailed November 5, 2018 (the "Office Action") be withdrawn.

The applicant has reviewed the Office Action and submits that all objections and rejections raised in the Office Action have been appropriately resolved herein. Each objection and rejection is addressed below, preceded by a heading similar to that found in the Office Action.¹

Claims 1-12 were pending when the present Office Action was mailed. By this response, claims 1-12 have been canceled and 13-30 have been added. Support for the new claims may be found throughout the application, for example, in paragraphs [0029]-[0039], [0046], and [0051-0052], including Table 1 and accompanying figures. Accordingly, claims 13-30 are currently pending.

I. Response to the Double Patenting Rejection

Claims 1-12 were rejected as being unpatentable on the grounds of statutory double patenting over claims 1-12 of U.S. No. 9,042,337 (the "'337 patent"). By this response, claims 1-12 have been canceled, and claims 13-30 added, rendering the current double patenting rejection moot. In anticipation of an obviousness-type double patenting rejection because of certain similarities between the newly-added claims and the previously-issued claims, however, applicant has concurrently submitted a terminal disclaimer to the '337 patent. Consideration and allowance of the newly-added claims is requested.

¹ Silence regarding a position taken, or argument made, by the Office does not indicate any acquiescence to that position or argument. Furthermore, arguments made by the applicant with respect to a particular claim or claims apply only to those claim or claims, and not to other claims or patents/applications, unless specifically noted herein.

II. Conclusion

In view of the foregoing, the applicant accordingly requests reconsideration of the application and respectfully submit that the application is in condition for allowance. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to contact the undersigned at (206) 359-8000.

The applicant reserves the right to later pursue any previously pending or other broader or narrow claims that capture any subject matter supported by the present disclosure, including subject matter that might be found disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that the applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Please charge any underpayment or credit any overpayment to our Deposit Account No. 50-0665 under Order No. 061240-8017.US06, from which the undersigned is authorized to draw.

Dated: 6 May 2019

Respectfully submitted,

By /Stephen Bishop/
Stephen C. Bishop
Registration No.: 38,829

Perkins Coie LLP
P.O. Box 1247
Seattle, WA 98111-1247
Phone: (206) 359-8000
Fax: (206) 359-7198

Attorneys for Applicant

Application Number * 15/676,421 *	Application/Control No. 15/676,421	Applicant(s)/Patent under Reexamination Li et al.	
	Examiner PATEL, CHANDRAHAS B	Art Unit 2464	
Document Code - DISQ		Internal Document - DO NOT MAIL	

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed: <u>06 May 2019</u>	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:
/JEAN PROCTOR/ Technology Center: OPLC Telephone: (571)272-1040



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
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NOTICE OF ALLOWANCE AND FEE(S) DUE

25096 7590 06/05/2019
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

EXAMINER

PATEL, CHANDRAHAS B

ART UNIT

PAPER NUMBER

2464

DATE MAILED: 06/05/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06	8295

TITLE OF INVENTION: METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	09/05/2019

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25096 7590 06/05/2019
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06	8295

TITLE OF INVENTION: METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	09/05/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, CHANDRAHAS B	2464	370-330000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06	8295
25096 7590 06/05/2019 PERKINS COIE LLP - SEA General PATENT-SEA P.O. BOX 1247 SEATTLE, WA 98111-1247			EXAMINER PATEL, CHANDRAHAS B	
			ART UNIT 2464	PAPER NUMBER

DATE MAILED: 06/05/2019

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/676,421	Applicant(s) Li et al.	
	Examiner CHANDRAHAS PATEL	Art Unit 2464	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 5/6/2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 13-30. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file areply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/Chandrabas B Patel/ Primary Examiner, Art Unit 2464	
---	--

DETAILED ACTION

Allowable Subject Matter

Claims 13-30 are allowed.

The following is an examiner's statement of reasons for allowance:

Newly submitted claims 13-30 are allowable over prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHANDRAHAS PATEL whose telephone number is (571)270-1211. The examiner can normally be reached on Monday - Thursday 7:30 - 17:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Application/Control Number: 15/676,421
Art Unit: 2464

Page 3

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Chandahas B Patel/
Primary Examiner, Art Unit 2464

Issue Classification 	Application/Control No. 15/676,421	Applicant(s)/Patent Under Reexamination Li et al.
	Examiner CHANDRAHAS PATEL	Art Unit 2464

CPC						
Symbol					Type	Version
H04L	/	5	/	0053	F	2013-01-01
H04L	/	27	/	2601	I	2013-01-01
H04L	/	5	/	0007	I	2013-01-01
H04L	/	5	/	0044	I	2013-01-01
H04L	/	1	/	0003	I	2013-01-01
H04L	/	1	/	0009	I	2013-01-01
H04L	/	1	/	0029	I	2013-01-01
H04W	/	72	/	04	I	2013-01-01
H04J	/	11	/	005	I	2013-01-01
H04L	/	5	/	006	I	2013-01-01
H04W	/	52	/	146	I	2013-01-01
H04W	/	72	/	048	I	2013-01-01
H04L	/	5	/	0094	A	2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
/				

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	18	
/Chandrabas B Patel/ Primary Examiner, Art Unit 2464	29 May 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20190529

Issue Classification 	Application/Control No. 15/676,421	Applicant(s)/Patent Under Reexamination Li et al.
	Examiner CHANDRAHAS PATEL	Art Unit 2464

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L5/00	/	5	/	00
H04L27/26	/	27	/	26
H04L1/00	/	1	/	00
H04W72/04	/	72	/	04
H04J11/00	/	11	/	00
H04W52/14	/	52	/	14
NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	18	
/Chandrabas B Patel/ Primary Examiner, Art Unit 2464	29 May 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 15/676,421	Applicant(s)/Patent Under Reexamination Li et al.
	Examiner CHANDRAHAS PATEL	Art Unit 2464

☐ Claims renumbered in the same order as presented by applicant
 ☐ CPA
 ☐ T.D.
 ☐ R.1.47

CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	13	10	22												
2	14	11	23												
3	15	12	24												
4	16	13	25												
5	17	14	26												
6	18	15	27												
7	19	16	28												
8	20	17	29												
9	21	18	30												

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 18	
/Chandrabhas B Patel/ Primary Examiner, Art Unit 2464 (Primary Examiner) _____ (Date) 29 May 2019		O.G. Print Claim(s) 1	O.G. Print Figure 1

<i>Search Notes</i> 	Application/Control No. 15/676,421	Applicant(s)/Patent Under Reexamination Li et al.
	Examiner CHANDRAHAS PATEL	Art Unit 2464

CPC - Searched*		
Symbol	Date	Examiner
H04L 5/0053, 1/0003	10/31/2018	CBP
H04J 11/005	10/31/2018	CBP

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST search	10/31/2018	CBP
Inventor search	10/31/2018	CBP
EAST updated	05/29/2019	CBP

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04L	5/0053, 1/0003, 1/0009, 1/0029, 5/0007, 5/0044, 5/006, 27/2601, 5/0094	05/29/2019	CBP
H04J	11/005	05/29/2019	CBP
H04W	52/146, 72/04, 72/048	05/29/2019	CBP
US-PGPUB	Database Interference search	05/29/2019	CBP

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	38	(li and huang and lo and wang).in.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L2	59969	h04l5/0053.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L3	9	L2 and ((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L4	5046	h04j11/005.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L5	10	L4 and ((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L6	27078	h04l1/0003.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L7	10	L6 and ((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L8	56	((time\$1frequency (time adj frequency)) same voice same neighbor\$3)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:19
L9	18676	(time\$1frequency (time adj frequency)) same ofdm	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:41
L10	5480	(time\$1frequency (time adj frequency)) same ofdm same subcarrier	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:42
L11	49	(time\$1frequency (time adj frequency)) same ofdm same subcarrier same coordinate	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:42
L12	218	(time\$1frequency (time adj frequency)) same ofdm same subcarrier same (group with symbol)	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/29 10:43

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L13	177	h04l5/0053.cpc. and (identifier same mobile).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 11:00
L14	70	h04l5/0053.cpc. and (identifier same mobile same base).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 11:00
L15	23	h04l5/0053.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 11:00

EAST Search History

L16	10	h04l1/0003.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 11:13
L17	9	h04l1/0009.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 11:18
L18	4	h04l1/0029.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 12:59
L19	21	h04l5/0007.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 12:59
L20	7	h04l5/0044.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:00
L21	10	h04l5/006.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:01
L22	8	h04l27/2601.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:01
L23	13	h04l5/0094.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:02
L24	11	h04j11/005.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:02
L25	5	h04w52/146.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:03
L26	16	h04w72/04.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:04
L27	14	h04w72/048.cpc. and (identifier same mobile same base same signal).clm.	US-PGPUB; USPAT	OR	ON	2019/05/29 13:05
L28	4	(identifier same mobile same base same signal same time\$1frequency).clm.	US-PGPUB	OR	ON	2019/05/29 13:06

5/29/2019 1:12:51 PM

C:\Users\cpate11\Documents\EAST\Workspaces\15\15676421.wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Li et al.

Application No.: 14/676,421

Confirmation No.: 8295

Filed: August 14, 2017

Art Unit: 2464

For: METHOD AND SYSTEM FOR MULTI-
CARRIER PACKET COMMUNICATION
WITH REDUCED OVERHEAD

Examiner: Chandrahas B. Patel

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

MS Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In the Notice of Allowability mailed June 5, 2019, the Examiner allowed claims 13-30. Although applicant agrees with the Examiner's conclusion that these claims are allowable, applicant notes that the claims may be allowable for reasons other than those identified by the Examiner and does not concede that the Examiner's characterizations of the terms of the claims and the prior art are correct.

Dated: 5 September 2019

Respectfully submitted,

By /Stephen Bishop/
Stephen Bishop
Registration No.: 38,829
PERKINS COIE LLP
P.O. Box 1247
Seattle, Washington 98111-1247
(206) 359-8000
(206) 359-7198 (Fax)
Attorneys for Applicant

Electronic Patent Application Fee Transmittal				
Application Number:		15676421		
Filing Date:		14-Aug-2017		
Title of Invention:		METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
First Named Inventor/Applicant Name:		Xiaodong Li		
Filer:		Stephen C Bishop/Todd Nielsen		
Attorney Docket Number:		061240-8017.US06		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	500	500

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				500

Electronic Acknowledgement Receipt	
EFS ID:	37073137
Application Number:	15676421
International Application Number:	
Confirmation Number:	8295
Title of Invention:	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
First Named Inventor/Applicant Name:	Xiaodong Li
Customer Number:	25096
Filer:	Stephen C Bishop/Todd Nielsen
Filer Authorized By:	Stephen C Bishop
Attorney Docket Number:	061240-8017.US06
Receipt Date:	05-SEP-2019
Filing Date:	14-AUG-2017
Time Stamp:	12:19:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 500
RAM confirmation Number	E201995C20494255
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0612408017US06_IF_Transmita l_09_05_19.pdf	167994	yes	2
			3dbc413e6afb51a6fcddeb12410951407b2dce2		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Issue Fee Payment (PTO-85B)		1	1	
	Miscellaneous Incoming Letter		2	2	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30361	no	2
			e9dce47d689ecdf7ab99941ee15535aecea1ad0		
Warnings:					
Information:					
Total Files Size (in bytes):			198355		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

PART B - FEE(S) TRANSMITTALComplete and send this form, together with applicable fee(s), to: **Mail**

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25096 7590 06/05/2019
 PERKINS COIE LLP - SEA General
 PATENT-SEA
 P.O. BOX 1247
 SEATTLE, WA 98111-1247

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Todd Nielsen	(Depositor's name)
/Todd Nielsen/	(Signature)
5 September 2019	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06	8295

TITLE OF INVENTION: METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0	\$0	\$500	09/05/2019
EXAMINER	ART UNIT	CLASS-SUBCLASS				
PATEL, CHANDRAHAS B	2464	370-330000				

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
 (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Perkins Coie LLP

2

3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Neocific, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Bellevue, Washington

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☒ Payment by credit card.
☒ The Director is hereby authorized to charge any deficiencies or credit any overpayment to Deposit Account Number 50-0665.

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
☐ Applicant asserting small entity status. See 37 CFR 1.27
☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Stephen Bishop/Date 5 September 2019Typed or printed name Stephen BishopRegistration No. 38,829



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/676,421	10/15/2019	10447450	061240-8017.US06	8295

25096 7590 09/25/2019
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Xiaodong Li, Kirkland, WA;
Neocific, Inc., Bellevue, WA;
Haiming Huang, Bellevue, WA;
Titus Lo, Bellevue, WA;
Ruifeng Wang, Sammamish, WA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	15/676,421
Filing Date	August 14, 2017
First Named Inventor	Li et al.
Title	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
Art Unit	2464
Examiner Name	PATEL, CHANDRAHAS B
Attorney Docket Number	NEO-PT020.6

SIGNATURE of Applicant or Patent Practitioner

Signature	/Christina R. Walsh/	Date (Optional)	
Name	Christina R. Walsh	Registration Number	61553
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	Neo Wireless LLC		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)



I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

OR

03624



I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:



The address associated with the above-mentioned Customer Number

OR



The address associated with Customer Number:

OR



Firm or
Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Neo Wireless LLC



Inventor or Joint Inventor (title not required below)



Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)



Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)



Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

David Loo

Date (Optional)

Name

David Loo

Title

C.E.O., Neo Wireless LLC

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.



Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	38883945
Application Number:	15676421
International Application Number:	
Confirmation Number:	8295
Title of Invention:	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
First Named Inventor/Applicant Name:	Xiaodong Li
Customer Number:	25096
Filer:	Christina R. Walsh/Justin Slater
Filer Authorized By:	Christina R. Walsh
Attorney Docket Number:	061240-8017.US06
Receipt Date:	17-MAR-2020
Filing Date:	14-AUG-2017
Time Stamp:	16:43:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	NEO-PT020_6-Supplemental_ADS_EFS_20200317.PDF	1567343	no	10
			0f31c91603de2fcb0c20e144e2f8f6cd448d7e26		

Warnings:

Information:					
This is not an USPTO supplied ADS fillable form					
2	Assignee showing of ownership per 37 CFR 3.73	NEO-PT020_6-373c_aia0096_EFS-20200317.PDF	162807 4db4226e1c6bc6e13412542aab2e1b11c2e1f43d	no	3
Warnings:					
Information:					
3	Power of Attorney	NEO-PT020_6-Executed_POA_ByApplicant_aia0082_EFS-20200317.PDF	360500 5dcfe5d916b495b9972476569a10b7a8de2bf02b	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			2090650		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017-US06 NEO-PT020.6
		Application Number	15/676,421
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Xiaodong		Li			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Kirkland	State/Province	WA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1		1750 112th Ave. NE				
Address 2		Suite D159				
City	Bellevue	State/Province	WA			
Postal Code	98004	Country i	US			
Inventor 2					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Haiming		Huang			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Bellevue	State/Province	WA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1		1750 112th Ave. NE				
Address 2		Suite D159				
City	Bellevue	State/Province	WA			
Postal Code	98004	Country i	US			
Inventor 3					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Titus		Lo			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	~~061240-8017-US06~~ NEO-PT020.6	
		Application Number	15/676,421	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD			

City	Bellevue	State/Province	WA	Country of Residence	US
------	----------	----------------	----	----------------------	----

Mailing Address of Inventor:

Address 1	1750 112th Ave. NE				
Address 2	Suite D159				
City	Bellevue	State/Province	WA		
Postal Code	98004	Country i	US		

Inventor 4

Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ruifeng		Wang	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Sammamish	State/Province	WA	Country of Residence	US
------	-----------	----------------	----	----------------------	----

Mailing Address of Inventor:

Address 1	1750 112th Ave. NE				
Address 2	Suite D159				
City	Bellevue	State/Province	WA		
Postal Code	98004	Country i	US		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.

Add

Correspondence Information:Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).☐ An Address is being provided for the correspondence information of this application.

Customer Number	~~25006~~ 03624		
Email Address	patentprocurement@perkinscoie.com eooffice@vklaw.com		

Add Email

Remove Email

Application Information:

Title of the Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		
Attorney Docket Number	~~061240-8017-US06~~ NEO-PT020.6	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	12	Suggested Figure for Publication (if any)	

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017-US06 NEO-PT020.6
		Application Number	15/676,421
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	25006 03624		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15/676,421	Continuation of	14720554	2015-05-22

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017-US06 NEO-PT020.6
		Application Number	15/676,421
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14720554	Continuation of	14248243	2014-04-08	9042337	2015-05-26
Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14248243	Continuation of	13115055	2011-05-24	8693430	2014-04-08
Prior Application Status		Patented		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13115055	Continuation of	11908257	2008-07-14	7948944	2011-05-24
Prior Application Status		Expired		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11908257	a 371 of international	PCTUS0638149	2006-09-28		
Prior Application Status		Expired		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
PCTUS0638149	Claims benefit of provisional	60721451	2005-09-28		
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.					

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)¹ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove			
Application Number	Country ¹	Filing Date (YYYY-MM-DD)	Access Code ¹ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	~~061240-8017-US06~~ NEO-PT020.6
		Application Number	<u>15/676,421</u>
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017-US06	NEO-PT020.6
		Application Number	15/676,421	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD			

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	061240-8017-US06 NEO-PT020.6
		Application Number	15/676,421
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

[Clear](#)

☒ Assignee ☐ Legal Representative under 35 U.S.C. 117 ☐ Joint Inventor

☐ Person to whom the inventor is obligated to assign. ☐ Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name ~~Neocell, Inc.~~ Neo Wireless LLC

Mailing Address Information For Applicant:

Address 1	4750 112th Ave. NE 123 West Wayne Avenue, Floor 1		
Address 2	Suite D160		
City	Bellevue Wayne	State/Province	WA PA
Country	US	Postal Code	98094 19087
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	~~061240-8017-US06~~	NEO-PT020.6
		Application Number	15/676,421	
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD			

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. Neo Wireless LLC ☒

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1		123 West Wayne Avenue, Floor 1		
Address 2				
City		Wayne	State/Province	PA
Country ⁱ	US	Postal Code	19087	
Phone Number		Fax Number		
Email Address				

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	~~/Stephen Bishop/~~ /Christina R. Walsh/		Date (YYYY-MM-DD)	2020-03-17 ~~2017-08-14~~
	First Name	~~Stephen~~ Christina R.	Last Name	~~Bishop~~ Walsh
Registration Number			~~38829~~ 61553	

Additional Signature may be generated within this form by selecting the Add button.

SUPPLEMENTAL APPLICATION DATA SHEET

PTO/AIA/14 (11-15)

Approved for use through 04/30/2017. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	~~061240-8017-US06~~ NEO-PT020.6
		Application Number	15/676,421
Title of Invention	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the international Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Neo Wireless LLC
Application No./Patent No.: 15/676,421 Filed/Issue Date: August 14, 2017
Titled: METHODS AND APPARATUS FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
Neo Wireless LLC, a corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: INVENTORS To: NEOCIFIC, INC.

The document was recorded in the United States Patent and Trademark Office at
Reel 051256, Frame 0932, or for which a copy thereof is attached.

2. From: NEOCIFIC, INC. To: CFIP NCF LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 051116, Frame 0396, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: CFIP NCF LLC To: NEO WIRELESS LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 051971, Frame 0226, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Christina R. Walsh/

Signature

Christina R. Walsh

Printed or Typed Name

March 17, 2020

Date

61553

Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/676,421	08/14/2017	Xiaodong Li	NEO-PT020.6

CONFIRMATION NO. 8295

POA ACCEPTANCE LETTER

3624
VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103



Date Mailed: 03/23/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/17/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/sleutchit/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/676,421	08/14/2017	Xiaodong Li	061240-8017.US06

CONFIRMATION NO. 8295

POWER OF ATTORNEY NOTICE

25096
PERKINS COIE LLP - SEA General
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247



Date Mailed: 03/23/2020

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/17/2020.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/sleutchit/

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 15/676,421

Filed: August 14, 2017

FILE: NEO-PT020.6

Patent No.: 10,447,450

DATE: March 30, 2020

Issued: October 15, 2019

DECLARATION OF LARGE ENTITY STATUS
PURSUANT TO 37 C.F.R. §1.27 (c)(1)

Commissioner for Patents
Mail Stop M Correspondence
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The above-identified patent is no longer entitled to small entity status and should be considered a large entity for all further payments.

Respectfully submitted,

NEO WIRELESS LLC

By /John C. Donch Jr./
John C. Donch Jr., Esquire
Registration No. 43,593
(215) 568-6400

Volpe and Koenig, P.C.
United Plaza
30 South 17th Street
Philadelphia, PA 19103-4009

JCD/dt

Electronic Acknowledgement Receipt	
EFS ID:	39009088
Application Number:	15676421
International Application Number:	
Confirmation Number:	8295
Title of Invention:	METHOD AND SYSTEM FOR MULTI-CARRIER PACKET COMMUNICATION WITH REDUCED OVERHEAD
First Named Inventor/Applicant Name:	Xiaodong Li
Customer Number:	3624
Filer:	John C. Donch/Diane Thatcher
Filer Authorized By:	John C. Donch
Attorney Docket Number:	NEO-PT020.6
Receipt Date:	30-MAR-2020
Filing Date:	14-AUG-2017
Time Stamp:	16:02:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Notification of loss of entitlement to small entity status	NEO_PT020.pdf	47832	no	1
			c71b87c5d9d6a11f825a783a114585b87f905780		

Warnings:

Information:	
Total Files Size (in bytes):	47832
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas Waco Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 6:21-cv-00025	DATE FILED 4/28/2021	U.S. DISTRICT COURT Western District of Texas Waco Division
PLAINTIFF Neo Wireless LLC		DEPENDANT LG Electronics Inc., LG Electronics U.S.A., Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,044,517	8/7/2018	Neo Wireless LLC
3 10,833,908	4/17/2018	Neo Wireless LLC
4 10,075,941	9/11/2018	Neo Wireless LLC
5 10,447,450	10/15/2019	Neo Wireless LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT		
CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas Waco Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 6:21-cv-00026	DATE FILED 4/28/2021	U.S. DISTRICT COURT Western District of Texas Waco Division
PLAINTIFF Neo Wireless LLC		DEPENDANT Apple Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,044,517	8/7/2018	Neo Wireless LLC
3 10,833,908	4/17/2018	Neo Wireless LLC
4 10,075,941	9/11/2018	Neo Wireless LLC
5 10,447,450	10/15/2019	Neo Wireless LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT		
CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL INC. and DELL TECHNOLOGIES INC.,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2021-01486
Patent 10,447,450 B2

Before CHARLES J. BOUDREAU, MICHELLE N. ANKENBRAND, and
MATTHEW S. MEYERS, *Administrative Patent Judges*.

BOUDREAU, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Dell Inc. and Dell Technologies Inc. (collectively, “Petitioner”) filed a Petition requesting *inter partes* review of claims 1–18 of U.S. Patent No. 10,447,450 (Ex. 1001, “the ’450 patent”). Paper 3 (“Pet.”). Neo Wireless LLC (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314(b) (2018); 37 C.F.R. § 42.4(a) (2020). We may not institute an *inter partes* review “unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a).

Upon consideration of the arguments and evidence presented, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to any of the challenged claims. Accordingly, we deny institution of an *inter partes* review of the ’450 patent.

II. BACKGROUND

A. Real Parties in Interest

Petitioner and Patent Owner identify themselves as the real parties in interest. Pet. 89; Paper 5, 1 (Patent Owner’s Mandatory Notices).

B. Related Matters

The parties advise us that the ’450 patent is involved in district court litigation between the parties, captioned as *Neo Wireless LLC v. Dell Technologies Inc.*, No. 6:21-cv-00024 (W.D. Tex.). Pet. 89; Paper 5, 1. Patent Owner also advises us that the ’450 patent also was involved formerly in two other district court proceedings, captioned *Neo Wireless LLC v. LG Electronics, Inc.*, No. 6:21-cv-00025 (W.D. Tex.) and *Neo Wireless LLC v. Apple Inc.*, No. 6:21-cv-00026 (W.D. Tex.). Paper 5, 1

C. The '450 Patent

The '450 patent, titled "Method and System for Multi-carrier Packet Communication with Reduced Overhead," issued October 15, 2019, from an application filed August 14, 2017, and claims priority through a series of continuation applications from a provisional application filed September 28, 2005. Ex. 1001, codes (22), (45), (54), (60), (63).¹

According to the '450 patent, bandwidth efficiency is one of the most important system performance factors for wireless communication systems. Ex. 1001, 1:33–34. In order to support the high degree of flexibility needed to accommodate different applications having different sized application payloads and different quality of service ("QoS") requirements in packet-based data communication, however, wireless communication systems generally must provide a high degree of flexibility. *Id.* at 1:34–40. In wireless systems based on the IEEE 802.16 standard, for example, multiple packet streams are established for each mobile station to support different applications, and each packet stream is mapped into a wireless connection. *Id.* at 1:42–47. Special scheduling messages, DL-MAP and UL-MAP, are utilized to broadcast scheduling decisions to the mobile stations. *Id.* at 1:47–50. According to the '450 patent, the MAP scheduling method defined by the IEEE 802.16 standard involves significant control overhead, amounting altogether to 52 bits, representing as much as 32.5% of overall data communication for application such as voice-over-IP ("VoIP") and resulting in a relatively low spectral efficiency. *Id.* at 1:51–2:13.

¹ Without conceding the validity of the priority claims, Petitioner identifies September 28, 2005, as the critical date. Pet. 1–2.

With the goal of improving spectral efficiency, the '450 patent describes a system and method for minimizing the control overhead in a multi-carrier wireless communication network by using a "time-frequency resource." Ex. 1001, 2:13–16, 2:45–47. One or more zones in the time-frequency resource may be dedicated for particular applications, such as VoIP applications. *Id.* at code (57), 2:47–50. By grouping applications of a similar type together within a zone, a reduction can be achieved in the number of bits necessary for mapping a packet stream to a portion of the time-frequency resource. *Id.* at 2:50–54.

Figure 3 of the '450 patent is reproduced below.

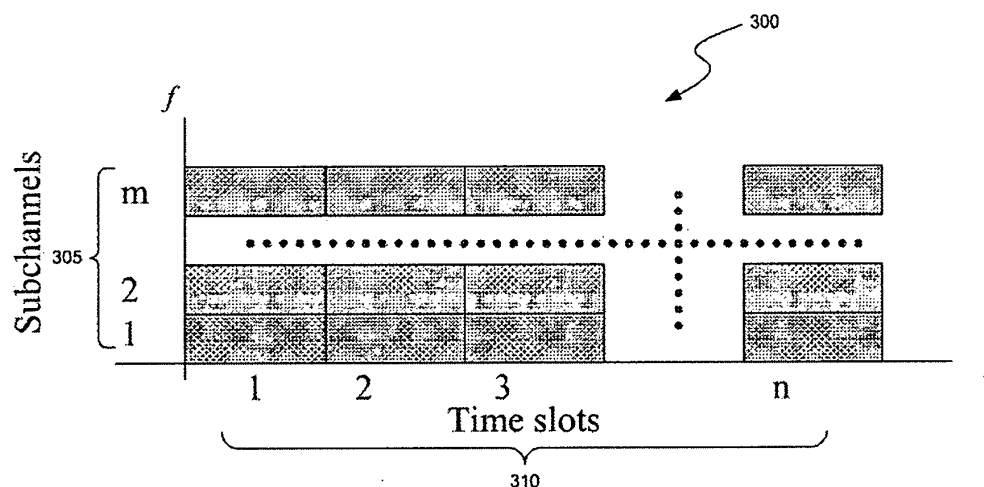


FIG. 3

Figure 3, above, is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, the frequency is divided into two or more subchannels 305, represented as subchannels 1, 2, . . . m; and time is divided into two or more time slots 310, represented as time slots 1, 2, . . . n. *Id.* at 4:18–22.

The '450 patent explains that "[t]he canonical division of the resource by both time and frequency provides a high degree of flexibility and fine granularity for resource sharing between multiple applications or multiple users of the resource." *Id.* at 4:22–26.

Figure 6 of the '450 patent is reproduced below.

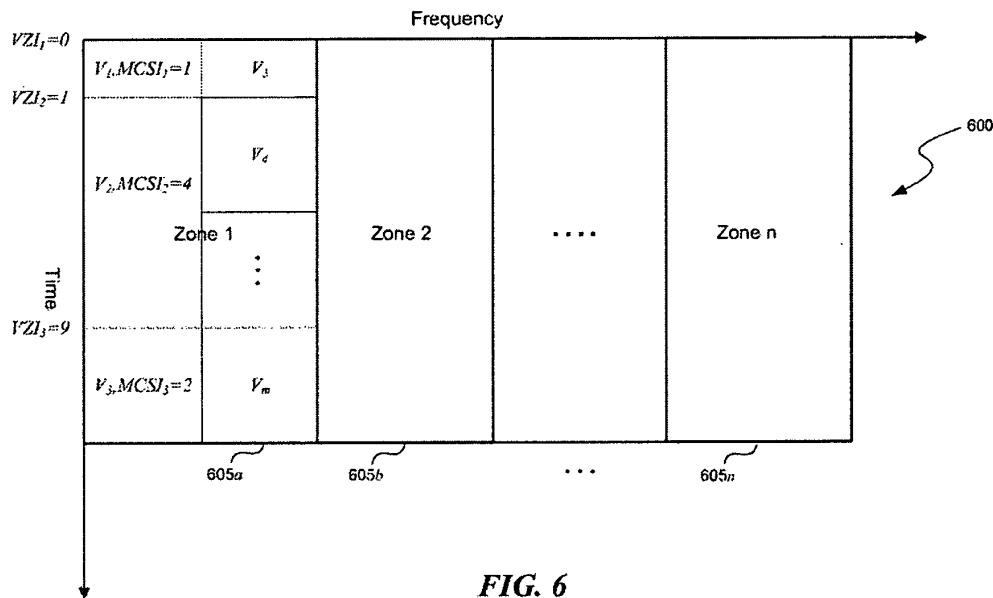


FIG. 6

Figure 6, above, is a block diagram of a frequency-time resource utilized by a wireless communication network. Ex. 1001, 2:32–33, 5:32–34. The '450 patent explains that Figure 6 depicts an alternative way of managing multiple packet streams in order to overcome the inefficiencies associated with the mapping of packet streams in typical wireless systems based on the IEEE 802.16 standard. *Id.* at 5:34–43. In Figure 6, time-frequency resource 600 is divided into zones 605a, 605b, . . . 605n, each of which is associated with a particular type of application (e.g., VoIP, video applications). *Id.* at 5:43–49. By grouping like applications together, the '450 patent explains, the amount of control overhead in MAC headers is

reduced. *Id.* at 5:49–51. More particularly, according to the '450 patent, when applications of a similar type are grouped together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a time-frequency segment can be achieved. *Id.* at 5:54–57. 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. *Id.* at 5:57–61. If the time-frequency resource is divided into two or more zones, the amount of control information necessary to map to a location relative to the starting point of the zone may be significantly less than the amount of information necessary to map to an arbitrary starting and ending coordinate in the entire time-frequency resource. *Id.* at 5:64–6:2.

The '450 patent further explains that within each zone 605a, 605b, . . . 605n, the time-frequency resource may be further divided in accordance with certain rules to accommodate multiple packet streams $V_1, V_2, \dots V_m$. Ex. 1001, 6:3–6. For example, as depicted in Figure 6, zone 605a is divided into multiple columns, and the packet streams are arranged from top down in each column and from left to right across the columns. *Id.* at 6:6–9. The width of each column can be a certain number of subcarriers, and each packet stream $V_1, V_2, \dots V_m$ may be associated with an application. *Id.* at 6:9–11. For example, V_1 is the resource segment to be used for the first voice packet stream, V_2 is the resource segment to be used for the second voice packet stream, etc. *Id.* at 6:12–14. Further, according to the '450 patent, when the zones are further subdivided into time-frequency segments in accordance with certain rules, a mapping of packet streams to segments may be achieved using a one-dimensional offset with respect to the origin of

the zone rather than the two-dimensional (i.e., starting time-frequency coordinate and ending time-frequency coordinate relative to the starting point of the zone) mapping method discussed above. *Id.* at 6:22–29.

The '450 patent further describes use of a “basic resource unit,” which is the resource utilized by the highest available modulation coding scheme (“MCS”) associated with a particular packet stream, such that the resources used by other MCSs can be represented as integer multiples of the basic unit. *Id.* at 6:45–52. Once the MCS 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, and 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. *Id.* at 7:7–18. The '450 patent explains that using basic resource units as the granularity of a location offset to the packet stream thus reduces the number of bits required to represent its location with the zone. *Id.* at 7:28–30.

D. Illustrative Claims

Claims 1, 7, and 13, reproduced below, are illustrative of the challenged claims:

1. An operating method for a wireless network comprising at least a base station and a mobile station, the wireless network employing 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 method comprising:

- assigning an identifier to the mobile station;

transmitting a signal containing information from the base station to the mobile 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 $N=2, 4, \text{ or } 8$; and

receiving by the mobile station the transmitted signal; and

recovering by the mobile station the information from the received signal based on the starting time-frequency coordinate and N in conjunction with the identifier assigned to the mobile station.

7. 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:

receive an identifier from a base station in a cell in which the mobile device is operating; and

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 $N=2, 4, \text{ or } 8$; and

recover the information from the received signal using the starting time-frequency coordinate and N in conjunction with the received identifier.

13. A base station 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 base station configured to:

- provide an identifier to a mobile device in the cell;
- allocate a segment of time-frequency resource for carrying information to the mobile device, 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; and
- transmit a signal containing the information to the mobile device in a manner that allows the mobile device to recover the information using the starting time-frequency coordinate and N in conjunction with the provided identifier.

Ex. 1001, 12:47–67, 13:15–33, 14:7–26.

E. Evidence

Petitioner relies on the following prior art references:

Kim et al., US 2005/0157803 A1, published July 21, 2005 (Ex. 1005, “Kim”);

IEEE Std 802.16, 2004 Edition, *IEEE Standard for Local and metropolitan area networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems* (Oct. 1, 2004) (Ex. 1008, “IEEE802.16-2004”).

Petitioner also relies on a Declaration of Zhi Ding, Ph.D. (Ex. 1003).
Patent Owner relies on a Declaration of William P. Alberth, Jr. (Ex. 2001).

F. Asserted Ground

Petitioner asserts that claims 1–18 are unpatentable under 35 U.S.C. § 103(a) over the combination of Kim and IEEE802.16-2004. Pet. 10, 20–66.

III. ANALYSIS

A. Legal Standards

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A patent claim is unpatentable for obviousness if the differences between the claimed subject matter and the prior art are “such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” 35 U.S.C. § 103(a).²

The ultimate determination of obviousness is a question of law, but that determination is based on underlying factual findings. . . . The underlying factual findings include (1) “the scope and content of the prior art,” (2) “differences between the prior art and the claims at issue,” (3) “the level of ordinary skill in the pertinent art,” and (4) the presence of secondary considerations of nonobviousness such “as commercial success, long felt but unsolved needs, failure of others,” and unexpected results.

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103. Because the ’450 patent is alleged to have an effective filing date before the effective date of the applicable AIA amendments, we refer to the pre-AIA version of 35 U.S.C. § 103.

In re Nuvasive, Inc., 842 F.3d 1376, 1381 (Fed. Cir. 2016) (citing *inter alia* *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)).

“To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Furthermore, in assessing the prior art, the Board must consider whether a person of ordinary skill would have been motivated to combine the prior art to achieve the claimed invention. *Nuvasive*, 842 F.3d at 1381.

As the Supreme Court has held, “because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known,” “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418–19 (2007).

B. Level of Ordinary Skill in the Art

Petitioner alleges a person having ordinary skill in the art as of the critical date of the ’450 patent “would have had at least a Bachelor’s degree in an academic area emphasizing electrical engineering, computer engineering, or a similar discipline, and at least two years of experience in the field working with, teaching, or researching wireless communication networks.” Pet. 8–9 (citing Ex. 1003 ¶ 32). Petitioner further contends that “[s]uperior education could compensate for a deficiency in work experience, and vice-versa.” *Id.* at 9 (citing Ex. 1003 ¶ 32). Patent Owner does not provide its own assessment regarding the level of skill in the art, or

otherwise dispute Petitioner's assertion. *See generally* Prelim. Resp.; *see also* Ex. 2001 ¶ 23 (Mr. Alberth stating that he "accept[s] Dr. Ding's proposed qualifications" of a person of ordinary skill in the art for purposes of his Declaration).

Based on our review of the record at this stage, we find that Petitioner's proposal is consistent with the level of skill reflected in the prior art references of record. *See Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007) (listing the type of problems encountered in the art, prior art solutions to those problems, and the sophistication of the technology as factors that may be considered in determining the level of ordinary skill in the art). *See also Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required "where the prior art itself reflects an appropriate level and a need for testimony is not shown").

Accordingly, for purposes of this decision, we adopt Petitioner's definition of the person of ordinary skill in the art.

C. *Claim Construction*

In an *inter partes* review based on a petition filed on or after November 13, 2018, we interpret claim terms using "the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b) (2021).

Petitioner argues that based on the evidence, the "striking similarities between the prior art's description of the claimed elements and that found within the '450 Patent specification, and the well-established principle that

‘claim terms need only be construed to the extent necessary to resolve the controversy,’ no formal claim constructions are necessary in this proceeding.” Pet. 8 (quoting *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011)).

Patent Owner responds that the Petition should be denied for failing to take a position on claim construction or to disclose or apply its claim construction positions from the parallel litigation between the parties in the Western District of Texas, in which, Patent Owner contends, Petitioner is asking the court for construction of the claim phrase “the segment having a starting time-frequency coordinate.” Prelim. Resp. 45–53 (citing, e.g., Ex. 2011, 17–20 (Defendants’ Opening Claim Construction Brief, Case No. 6:21-cv-00024); Ex. 2016, 14–15 (Defendants’ Reply Claim Construction Brief, Case No. 6:21-cv-00024)). Patent Owner further points out that, for its part, it contends in co-pending district court litigation that “the claim term ‘the segment having a starting time-frequency coordinate’ is entitled to its plain and ordinary meaning.” *Id.* at 2 (citing Ex. 2014, 25–26 (Plaintiff Neo Wireless LLC’s Responsive Claim Construction Brief, Case No. 6:21-cv-00024)).

On this record, we agree with Petitioner that no terms or phrases in the claims require express construction. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Obviousness of Claims 1–18 over Kim and IEEE802.16-2004

Petitioner alleges claims 1–18 would have been obvious over Kim and IEEE802.16-2004, relying in part on Dr. Ding’s Declaration. Pet. 9–83

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(citing Ex. 1003 ¶¶ 63–116, 118–132, 134–142, 144–147, 149–182, 188, 189). Patent Owner responds, relying in part on Mr. Alberth’s Declaration. Prelim. Resp. 2–29 (citing Ex. 2001 ¶¶ 25–54). Neither party alleges or presents evidence of secondary considerations of obviousness or nonobviousness.

We begin our analysis with a brief overview of Kim and IEEE802.16-2004, and we then address the parties’ contentions with respect to the challenged claims.

1. Kim

Kim, titled “Modulating and Coding Apparatus and Method in a High-rate Wireless Data Communication System,” describes an apparatus and method for determining a modulation order of packet data to be transmitted through a subcarrier (i.e., an orthogonal frequency carrier used in orthogonal frequency-division multiplexing (“OFDM”), such as in an IEEE 802.16a system) in a transmission apparatus. Ex. 1005, codes (54), (57), ¶¶ 7–11, 14, 26–32. Kim describes a resource allocation scheme in which channel resources are allocated to multiple users. *Id.* ¶ 13.

Figure 12 of Kim is reproduced below.

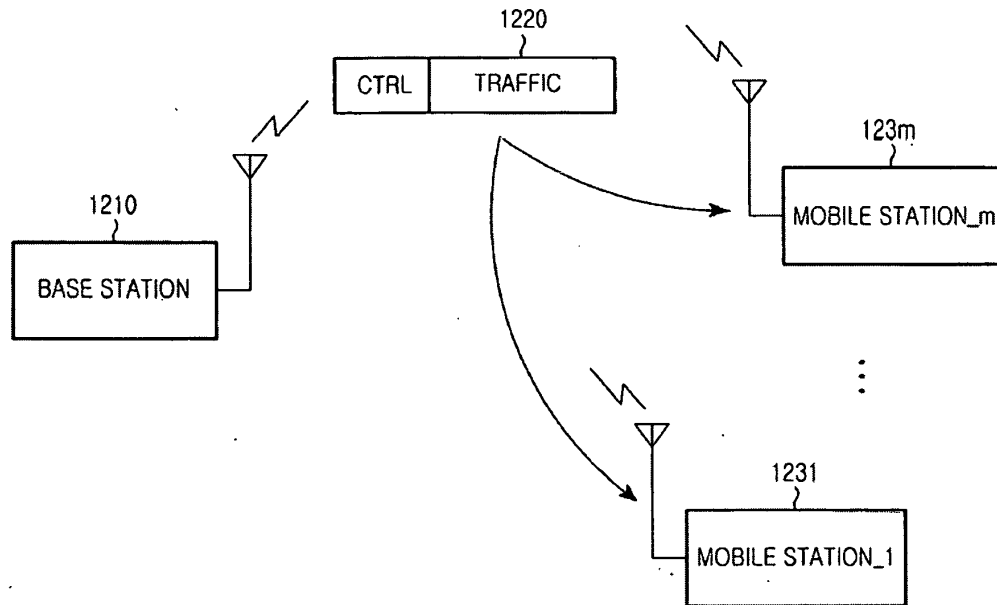


FIG.12

Figure 12, above, is “a block diagram illustrating an operation between a base station and mobile stations in accordance with an embodiment of [Kim’s] invention.” Ex. 1005 ¶ 49. With reference to Figure 12, base station 1210 communicates with mobile stations 1231–123m. *Id.* ¶ 85. According to Kim, base station 1210 transmits data in a “frame” (e.g., frame 1220 in Figure 12), where each frame includes multiple “slots.” *Id.* ¶ 85, Fig. 11. Kim explains that “the amount of channel resources allocated to one user is determined based on the number of subchannels . . . and the number of slots,” where a “subchannel” refers to a set of subcarriers, representing divisions of frequency bandwidth. *Id.* ¶¶ 11, 14, 52–54, 58. Each “channel resource” in Kim’s network includes a single subchannel spanning a single time slot, where “one slot comprises one or more OFDM symbols.” *Id.* ¶¶ 14, 53, 58.

In Kim's system, data is transmitted over one or more channel resources using an adaptive coding and modulation scheme corresponding to a Modulation order Product code Rate, which depends on the number of subchannels allocated to a user's data in a slot. Ex. 1005, code (57), ¶¶ 61–67. Figure 6 of Kim is reproduced below.

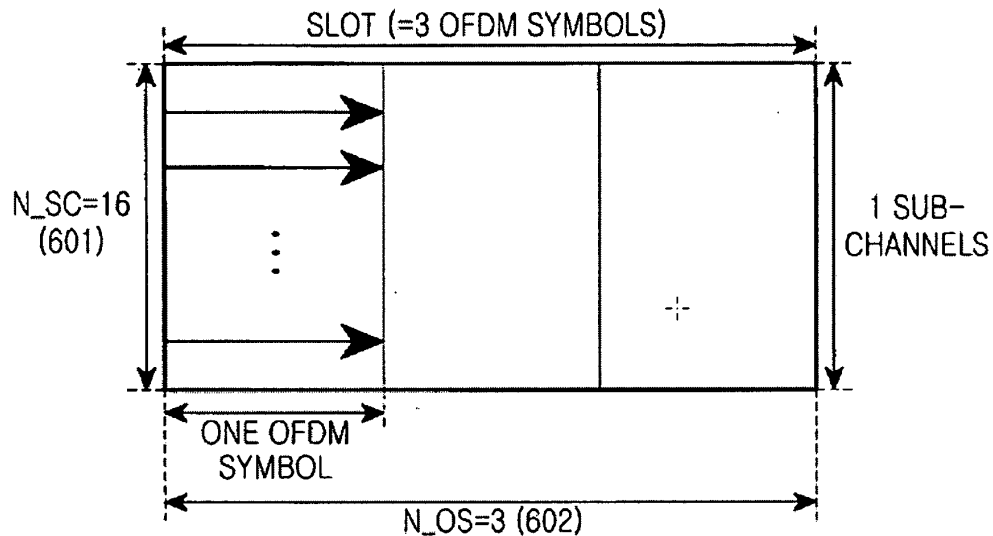


FIG.6

Figure 6, above, is “a diagram illustrating factors used for determining the number of modulation symbols allocated per slot according to an embodiment of [Kim’s] invention in an [Orthogonal Frequency Division Multiple Access] system.” Ex. 1005 ¶ 43. In the embodiment shown in Figure 6, “three OFDM symbols are transmitted for one slot,” such that factor “N_OS” 602, representing “the number of OFDM symbols allocated per slot,” is shown to equal 3; whereas factor “N_SC 601,” representing “the number of subcarriers allocated per subchannel and OFDM symbol,” is

shown to equal 16. *Id.* ¶¶ 56, 57, 60. Whereas Figure 6 illustrates N_SC 601 as being equal to 16, Kim explains that “[t]he number of subcarriers allocated per subchannel is variable according to the number of OFDM symbols being transmitted.” *Id.* ¶ 60. According to Kim, “[b]ecause it is assumed in FIG. 6 that N_SC=16 and N_OS=3, the number of modulation symbols allocated to channel resources comprises one subchannel which is 48 (=16×3),” and “[w]hen expressed with the number of subcarriers rather than modulation symbols, N_MS [(i.e., the number of modulation symbols allocated to channel resource comprised of one slot and one subchannel)] represents 48 subcarriers.” *Id.* ¶¶ 58–60.

2. IEEE802.16-2004

IEEE802.16-2004 is a 2004 update to the IEEE 802.16 standard, revising and consolidating IEEE Std 802.16-2001, IEEE Std 802.16a-2003, and IEEE Std 802.16c-2002. Ex. 1008, 4, 37. “Th[e] revised standard specifies the air interface, including the medium access control layer and multiple physical layer specifications, of fixed [broadband wireless access] systems supporting multiple services.” *Id.* at 37.

3. Claim 1

a. Petitioner’s Contentions

Petitioner contends that claim 1 is unpatentable over Kim and IEEE802.16-2004. Pet. 31–64. First, Petitioner argues, to the extent that the preamble of claim 1 is deemed limiting,³ Kim discloses “wireless data communication networks” and an “operation between a base station and mobile stations,” which Petitioner alleges to be consistent with “fixed

³ We need not decide for purposes of this Decision whether the preambles of any of the challenged claims are limiting.

broadband wireless access systems” that include a “base station” communicating with a “subscriber station” in IEEE802.16-2004. *Id.* at 31–32 (citing Ex. 1003 ¶¶ 96–98; Ex. 1005 ¶¶ 5, 84, 86, Fig. 12; Ex. 1008, 1 (title), 43, 47). Thus, Petitioner contends, “the Kim-IEEE802.16-2004 network implements an ‘operating method for a wireless network comprising at least a base station and a mobile station,’” as recited in the preamble of claim 1. *Id.* at 33 (emphasis omitted) (citing Ex. 1003 ¶ 99). Petitioner further contends that Kim’s base station transmits “user data in a frame,” such that “user data is multiplexed every transmission frame,” and that IEEE802.16-2004 provides additional details of a “frame structure,” such that “the Kim-IEEE802.16-2004 network employs ‘a frame structure of multiple frames for transmission,’” as recited in the preamble of claim 1. *Id.* at 33–34 (emphases omitted) (citing Ex. 1003 ¶¶ 100–102; Ex. 1005 ¶¶ 14, 75, Fig. 11; Ex. 1008, 535, 536 (Fig. 218)).

Further, Petitioner contends, each frame in the Kim-IEEE802.16-2004 network consists of multiples time slots, which Petitioner maps to the recited “plurality of time intervals,” and both Kim and IEEE802.16-2004 disclose time slots that span multiple OFDM symbols. Pet. 34–37 (citing Ex. 1003 ¶¶ 103–110; Ex. 1005 ¶¶ 14, 57, Figs. 6, 11; Ex. 1008, 529, 532, 533, 534 (Fig. 216), 536 (Fig. 218)). Lastly with respect to the preamble of claim 1, Petitioner contends that “Kim discloses a ‘number of subcarriers allocated per subchannel and OFDM symbol,’” while “IEEE802.16-2004 specifies an OFDMA symbol ‘is made up of subcarriers’ and defines a parameter ‘number of used subcarriers’ (‘N_{used}’) to ‘characterize the OFDMA symbol.’” *Id.* at 39–40 (emphases omitted) (citing Ex. 1003 ¶¶ 111, 112; Ex. 1005 ¶¶ 14, 56, 60, Fig. 2; Ex. 1008, 530, 531). Therefore, Petitioner argues, “the Kim-IEEE802.16-2004 network performs transmission using

OFDM symbols, with ‘each OFDM symbol containing a plurality of frequency subcarriers,’” as recited in the preamble of claim 1. *Id.* at 40 (emphasis omitted) (citing Ex. 1003 ¶ 113).

With respect to claim 1’s recitation of “assigning an identifier to the mobile station,” Petitioner argues that prior art knowledge of that step “is acknowledged in the Background of the ’450 patent itself, which acknowledges that the IEEE 802.16 standard specifies a 16-bit ‘connection ID (CID) . . . to identify the mobile station,’” and that “[s]uch prior art knowledge is further evidenced in Kim and IEEE802.16-2004.” Pet. 41 (emphasis omitted) (quoting Ex. 1001, 1:51–55) (citing Ex. 1003 ¶¶ 114–116; Ex. 1005 ¶¶ 72, 85; Ex. 1008, 43, 536 (Fig. 218), 557 (Table 275)).

With respect to claim 1’s recitation of “transmitting a signal containing information from the base station to the mobile station over a segment of time-frequency resource,” Petitioner argues that “Kim discloses that information for the user is transmitted over ‘channel resources’ consisting of multiple subchannels in frequency (e.g., a frequency resource) and one or more slots in time (e.g., a time resource),” and that “[t]he multiple subchannels in frequency and one or more slots in time collectively comprise a ‘time-frequency resource.’” Pet. 42 (emphases omitted) (citing Ex. 1003 ¶ 118; Ex. 1005 ¶ 58, Fig. 5). Pointing to an example in Kim in which one user is allocated all subchannels of one slot and some subcarriers of a second slot, while a second user is allocated the remaining subcarriers of the second slot, as well as a separate example in which a single user is allocated subchannels in two different slots, Petitioner contends that

[w]ith these assignments in both time (e.g., x-axis time slots) and frequency (e.g., y-axis subcarriers), Kim discloses that user A and user B are allocated “channel resources” (the claimed “segment of time-frequency resource”) consisting of multiple

subchannels in frequency and one or more slots in time, over which information is transmitted to the user.

Id. at 42–44 (emphasis omitted) (citing Ex. 1003 ¶¶ 119–121; Ex. 1005 ¶¶ 58, 61–67, Figs. 5, 7).

Petitioner further contends that “prior art knowledge of transmission of a ‘starting time-frequency coordinate’ for resource allocation is acknowledged in the Background Section of the ’450 patent itself,” which, Petitioner argues, “explains that, according to the existing IEEE 802.16 standard, ‘resource allocation is identified in the time domain scale with a start symbol offset (8 bits) . . . and in the frequency domain scale with a start logical subchannel offset (6 bits).” Pet. 44 (emphases omitted) (citing Ex. 1001, 1:60–66; Ex. 1003 ¶ 123). According to Petitioner, a person of ordinary skill in the art would have found transmission of a resource allocation using a starting time-frequency coordinate as being part of such person’s general knowledge, as evidenced by the Background section of the ’450 patent, Kim, and IEEE802.16-2004 and would have found the same to be an obvious solution and design choice based on such knowledge. *Id.* at 44–48 (citing Ex. 1003 ¶¶ 123–128; Ex. 1005 ¶¶ 73, 75, 81, 82; Ex. 1008, 532 (Fig. 215), 536 (Fig. 218), 558).

With regard to the limitation “the segment comprising N time-frequency resource units within a time interval,” Petitioner contends that “the Kim-IEEE802.16-2004 network allocates resources in multiples of a ‘subchannel’ in frequency and a ‘slot’ in time, which Kim refers to as a ‘channel resource’ and which IEEE802.16-2004 refers to as a ‘minimum possible data allocation unit’ (the claimed ‘resource unit’).” Pet. 48 (emphases omitted) (citing Ex. 1003 ¶ 130; Ex. 1005 ¶¶ 11, 53, 54, 58, Figs. 5, 7, 8; Ex. 1008, 530, 532). Petitioner contends, for example, that

Kim's Figures 6 and 7 depict an example resource allocation that includes a resource unit of one slot in time and one sub-channel in frequency. *Id.* at 48–49 (citing Ex. 1003 ¶ 130; Ex. 1005, Figs. 6, 7). Petitioner further contends, “Figure 5 . . . [of] Kim shows an example where ‘user A’ is allocated ‘a different number of subchannels for each slot’ . . . and user B ‘has the same number of subchannels for every slot,’” while “Figure 7 . . . [of] Kim shows an example where ‘user A transmits an OFDM symbol through 12 subchannels in a first slot SLOT(0) and an OFDM symbol through 8 subchannels in a second slot SLOT(1).’” *Id.* at 49–51 (emphasis omitted) (citing Ex. 1003 ¶¶ 131, 132; Ex. 1005 ¶¶ 62, 63, Figs. 5, 7). According to Petitioner, “because Kim discloses allocating resources (the claimed ‘segment’) that include an integer number (‘N’) of subchannels per slot (the claimed ‘resource units’), a [person of ordinary skill in the art] would have understood that the Kim-IEEE802.16-2004 network allocates a resource segment ‘comprising N time-frequency resource units within a time interval.’” *Id.* at 51 (emphasis omitted). Petitioner asserts that this is consistent with the ’450 patent, insofar as “neither the language of [the recited claim limitation] nor the written description of the ’450 patent requires that the claimed ‘segment’ must consist of **only** ‘N time-frequency resource units within a time interval,’” but instead use open-ended “comprising” claim language. *Id.* (emphasis omitted) (citing Ex. 1003 ¶ 134). Moreover, based on Kim’s description of Figure 7 as showing “user A transmits an OFDM symbol through 12 subchannels in a first slot SLOT(0) and an OFDM symbol through 8 subchannels in a second slot SLOT(1),” Petitioner contends that “the Kim-IEEE802.16-2004 network discloses allocating 8 subchannels within a time slot,” thereby satisfying the

claim language “where $N=2, 4, \text{ or } 8$.” *Id.* at 54–55 (emphases omitted) (citing Ex. 1003 ¶¶ 140–142; Ex. 1005 ¶ 63, Fig. 7).

With respect to the step of “receiving by the mobile station the transmitted signal,” Petitioner contends that Kim discloses operations performed by a “receiver” of a mobile station, citing disclosure in Kim that “[e]ach mobile station, or receiver, should first determine whether a signal transmitted by a base station is a signal transmitted to the mobile station itself” and “[t]he mobile station performs demodulation and decoding only on the signal transmitted to the mobile station itself, thereby restoring its user data.” Pet. 56–57 (alterations in original) (emphases omitted) (quoting Ex. 1005 ¶ 72) (citing Ex. 1003 ¶¶ 145–146; Ex. 1005 ¶¶ 71, 73, 78–83, Fig. 10).

Finally, with respect to the step of “recovering by the mobile station the information from the received signal based on the starting time-frequency coordinate and N in conjunction with the identifier assigned to the mobile station,” Petitioner contends that the IEEE802.16-2004 DL-MAP control message includes an “OFDMA symbol offset” and “subchannel offset” that collectively represent the claimed “starting time-frequency” and that the Kim-IEEE802.16-2004 combination network would utilize such symbol offset and subchannel offset to implement Kim’s “location information.” Pet. 57–58 (emphasis omitted) (citing Ex. 1003 ¶ 149; Ex. 1005 ¶¶ 73, 75, 81, 82; Ex. 1008, 557 (Table 275), 558). Petitioner further contends that “Kim discloses that the ‘control message’ in each frame also indicates ‘the number of subchannels’ allocated for the user data,” permitting Kim’s mobile station to “perform data demodulation and decoding” of user data, consistent with the specification in IEEE802.16-2004 that the DL-MAP message in each frame includes a parameter that

indicates the “number of subchannels with subsequent indexes, used to carry the burst.” *Id.* at 58 (emphasis omitted) (citing Ex. 1003 ¶ 150; Ex. 1005 ¶¶ 75, 76, 81, 82; Ex. 1008, 557 (Table 275), 558); *see also id.* at 58–60 (citing Ex. 1003 ¶¶ 151–153; Ex. 1005 ¶¶ 18, 58, 63, 81, 82, Fig. 10). Thus, Petitioner contends, “in the Kim-IEEE802.16-2004 combination, the mobile station recovers the information from the signal using both the starting time-frequency coordinate (e.g., the ‘OFDMA Symbol offset’ and ‘subchannel offset’ (as specified in IEEE802.16-2004)) and N (e.g., the number of subchannels (as specified by Kim)).” *Id.* at 60 (emphases omitted) (citing Ex. 1003 ¶ 154). Still further, Petitioner contends, “[r]ecovery of information in the Kim-IEEE802.16-2004 network occurs in conjunction with the identifier in at least two ways.” *Id.* at 61. First, Petitioner asserts, the identifier is used to determine whether data received in a frame is intended for the mobile station; and second, decryption of the data using a security association “identifier” is required for recovering information. *Id.* at 61–64 (citing Ex. 1003 ¶¶ 156–158, Ex. 1005 ¶¶ 72, 83; Ex. 1008, 46, 67, 71, 72, 73, 307, 308, 733).

b. Patent Owner’s Contentions

In response to Petitioner’s contentions, Patent Owner argues that the combination of Kim and IEEE802.16-2004 fails to teach a “segment of time-frequency resource,” “the segment having a starting time-frequency coordinate” and “comprising N time-frequency resource units within a time interval . . . where N=2, 4, or 8,” as recited in claim 1. Prelim. Resp. 11–29. Rather than teaching “a starting time-frequency coordinate,” Patent Owner contends, the Kim-IEEE802.16-2004 combination teaches only separate starting time and frequency coordinates, e.g., “a start symbol offset” in the

time dimension plus “a start logical subchannel offset” in the frequency dimension. *Id.* at 12–13.

Patent Owner argues that, as explained in the Background section of the ’450 patent, the IEEE 802.16 standard provides for multiple packet streams to be established for each mobile station to support different applications. Prelim. Resp. 3 (citing Ex. 1001, 1:42–45). Quoting the ’450 patent, Patent Owner argues, “[d]ue to the fact that different applications have different resource requirements, the allocated resource region is irregular from connection to connection,” and “[t]o accommodate this ‘irregular[ity]’ under the IEEE 802.16 standard, four parameters are used to allocate resources in the two independent dimensions of frequency and time.” *Id.* at 3–4 (first and third alterations in original) (emphasis omitted) (quoting Ex. 1001, 1:66–2:2) (citing Ex. 2001 ¶ 25). In particular, Patent Owner quotes, “[r]esource allocation is identified in the time domain scale with a start symbol offset (8 bits) and a symbol length (7 bits) and in the frequency domain scale with a start logical subchannel offset (6 bits) and a number of allocated subchannels (6 bits).” *Id.* at 4 (emphases omitted) (quoting Ex. 1001, 1:62–66). “Instead of spreading the various applications carried in packet streams throughout the available resource region[] per the IEEE 802.16 standard,” Patent Owner argues, “the inventors [of the ’450 patent] took a different approach: they ‘group[ed] like applications together,’” as illustrated in Figure 6 of the ’450 patent, “which in turn allowed the inventors to map the time-frequency resource by one-dimensional ‘time-frequency resource units’” and thereby reduce control overhead. *Id.* at 4–6 (third alteration in original) (quoting Ex. 1001, 5:43–53) (citing Ex. 1001, 2:48–49, 5:46–49, Fig. 6; Ex. 2001 ¶¶ 27–29).

According to Patent Owner, with support both from the '450 patent and from Mr. Alberth's Declaration,

[b]y effectively transforming the two independent dimensions of time and frequency into one time-frequency dimension measured by a basic resource unit having a fixed number of symbols in a fixed number of subcarriers that fits the resource requirements of a given application, the inventors achieved an advantageous reduction in the amount of data required to allocate resources.

Prelim. Resp. 8 (citing Ex. 1001, 7:28–30; Ex. 2001 ¶ 36). Moreover, Patent Owner argues, “[a] time-frequency resource unit is not an arbitrary combination of time and frequency units and is instead designed according to the application requirements of the application that is being grouped.” *Id.* at 9 (citing Ex. 2001 ¶ 38). In contrast, “no ‘time-frequency coordinate’ or ‘time-frequency resource unit’ is shown to be taught or suggested by the combination of Kim and IEEE802.16-2004.” *Id.* at 10. Rather,

[j]ust as in the IEEE 802.16 standard expressly distinguished in the background of the patent, these two references merely 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.

Id. Patent Owner further contends:

[B]y transforming time and frequency to a single dimension—time-frequency—measured in time-frequency resource units, the invention can use two parameters to map a packet stream: the starting time-frequency coordinate and N, the number of time-frequency resource units. Ex. 1001[,] 6:3–21, 7:7–39. Because there is no time-frequency dimension taught in Kim or IEEE802.16-2004, the combination lacks both innovative parameters. Instead, the combination of Kim and IEEE802.16-2004 uses an independent time dimension and an independent frequency dimension and requires four parameters to map a

packet stream, just like the prior art distinguished in the Background of the '450 patent.

Id. (citing Ex. 2001 ¶ 39).

c. Discussion

Having reviewed the parties' filings and evidence, we conclude that Petitioner has not shown a reasonable likelihood of prevailing in showing that claim 1 is unpatentable over the combination of Kim and IEEE802.16-2004. In particular, we agree with Patent Owner 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." Instead, as Patent Owner argues, we find in Kim and IEEE802.16-2004 teachings only of independent time and frequency coordinates and independent time and frequency units akin to those described in the Background section of the '450 patent and subsequently distinguished in the patent's Detailed Description section. We find no acknowledgement in Kim or IEEE802.16-2004 of the tradeoff described in the '450 patent between the flexibility afforded by the IEEE 802.16 standard to accommodate different applications having different size data payloads and different QoS requirements, on the one hand, and bandwidth efficiency and minimization of control overhead, on the other hand (*see, e.g.*, Ex. 1001, 1:33–52), let alone any teaching or suggestion of use of a combined time-frequency resource.

We acknowledge Petitioner's arguments that, for example, a person of ordinary skill in the art "would have understood that the Kim-IEEE802.16-2004 network transmits 'a signal containing information from the base station to the mobile station over a segment of time-frequency resource'" (Pet. 44 (emphasis omitted)), "would have found transmission of a resource

allocation using a starting time-frequency coordinate as being part of [such person's] general knowledge . . . and would have found transmission of a starting time-frequency coordinate to have been an obvious solution and design choice" (*id.* at 44–45), and "would have understood that, in the Kim-IEEE802.16-2004 network, a resource segment is transmitted with a 'starting time-frequency coordinate'" (*id.* at 47–48 (emphasis omitted)). Nevertheless, we find that such contentions are premised on Petitioner and its declarant's conclusory conflation of separate frequency subchannels and time slots as the recited singular "time-frequency resource" and separate starting time and frequency coordinates as the recited singular "starting time-frequency coordinate." *See, e.g., id.* at 42 ("The multiple subchannels in frequency and one or more slots in time collectively comprise a '*time-frequency resource*.'" (citing Ex. 1003 ¶ 118)), 44 (arguing that a person of ordinary skill in the art "would have understood prior art knowledge of transmission of a resource allocation that is identified in time by a **start symbol offset**, and is identified in frequency by a **start logical subchannel offset** (collectively, the claimed '*starting time-frequency coordinate*')") (citing Ex. 1003 ¶ 123)), 47 ("In the Kim-IEEE802.16-2004 network, a data region (the claimed 'segment') . . . is transmitted with (i) a '*starting time . . . coordinate*' . . . and (ii) a '*starting . . . frequency coordinate*' . . . (collectively, the claimed '*starting time-frequency coordinate*').") (citing Ex. 1003 ¶ 127)).⁴

⁴ Notably, Petitioner's declarant Dr. Ding's testimony with respect to the disputed claim limitations is substantively identical to the argument in the Petition and provides no additional basis to support Petitioner's conflation of separate time and frequency resources and coordinates as the recited time-frequency claim elements. *Compare, e.g.,* Ex. 1003 ¶¶ 118–144, *with* Pet. 42–55; *see* 37 C.F.R. § 42.65 ("Expert testimony that does not disclose

Therefore, based on the current record, we determine that Petitioner has not shown a reasonable likelihood of demonstrating that independent claim 1 would have been obvious over Kim and IEEE802.16-2004.

4. Claims 2–6

We have considered Petitioner’s arguments and evidence for claims 2–6, which depend directly or indirectly from claim 1. Pet. 65–78. Petitioner contentions for those claims do not remedy the deficiencies discussed in Section III.D.3 above with respect to claim 1. Accordingly, for the reasons discussed with respect to claim 1, we conclude that Petitioner has not demonstrated a reasonable likelihood that it would prevail in showing that claims 2–6 are unpatentable under 35 U.S.C. § 103(a) as obvious over Kim and IEEE802.16-2004.

5. Claims 7–18

Like claim 1, independent claims 7 and 13 each recite, *inter alia*, “a segment of time-frequency resource . . . having a starting time-frequency coordinate and . . . comprising N time-frequency resource units within a time interval, . . . where N=2, 4, or 8.” See *supra* Section II.D. We have considered Petitioner’s arguments and evidence for independent claims 7 and 13 and claims 8–12 and 14–18 dependent therefrom. Pet. 78–83. Petitioner contentions for those claims do not remedy the deficiencies discussed in Section III.D.3 above with respect to claim 1. Accordingly, for the reasons discussed with respect to claim 1, we conclude that Petitioner has not demonstrated a reasonable likelihood that it would prevail in

the underlying facts or data on which the opinion is based is entitled to little or no weight.”).

showing that claims 7–18 are unpatentable under 35 U.S.C. § 103(a) as obvious over Kim and IEEE802.16-2004.

6. Conclusion

Petitioner has not shown a reasonable likelihood that any of claims 1–18 would have been obvious over IEEE802.16-2004 and Kim.

E. Discretionary Denial Under 35 U.S.C. §§ 314(a) and 325(d)

Patent Owner contends the Board should exercise its discretion to deny institution under 35 U.S.C. § 314(a) in view of the parallel district court litigation between the parties and in light of the discretionary factors set forth in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential). Prelim. Resp. 34–45. Patent Owner also contends the Board should exercise its discretion to deny institution under 35 U.S.C. § 325(d). *Id.* at 29–34.

Because we deny institution of *inter partes* review based on the merits of the Petition in this case, we need not and do not address these other contentions of Patent Owner.

IV. CONCLUSION

For the foregoing reasons, Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to any of claims 1–18 of the ’450 patent on the asserted ground, and we deny institution of *inter partes* review.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied*, and no trial is instituted.

IPR2021-01486
Patent 10,447,450 B2

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DOCKET NO. 2:22-cv-00093	DATE FILED 3/29/2022	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF Neo Wireless LLC		DEPENDANT Toyota Motor North America, Inc., Toyota Motor Sales, U.S.A., Inc., & Toyota Motor Engineering & Manufacturing North America, Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
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6 10,965,512	3/30/2021	Neo Wireless LLC

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DOCKET NO. 2:22-cv-00094	DATE FILED 3/29/2022	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF Neo Wireless LLC		DEPENDANT General Motors Company and General Motors LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

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DOCKET NO. 2:22-cv-00095	DATE FILED 3/29/2022	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF Neo Wireless LLC		DEPENDANT Tesla Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

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DOCKET NO.	DATE FILED 3/29/2022	U.S. DISTRICT COURT Eastern District of Tennessee
PLAINTIFF Neo Wireless LLC		DEFENDANT Volkswagen Group of America, Inc. & Volkswagen Group of America Chattanooga Operations, LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

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Case 1:22-cv-00076-TAV-SKL Document 2 Filed 03/29/22 Page 1 of 2 PageID #: 314

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DOCKET NO. 3:22-cv-00220	DATE FILED 3/29/2022	U.S. DISTRICT COURT for the Middle District of Tennessee
PLAINTIFF NEO Wireless, LLC		DEFENDANT Nissan North America Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8467366		See attached complaint
2 10833408		
3 10075941		
4 10447450		
5 10965512		

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1 10771302		
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DOCKET NO. 3:22-cv-01252	DATE FILED 7/15/2022	U.S. DISTRICT COURT Northern District of Ohio
PLAINTIFF Neo Wireless LLC		DEFENDANT FCA US, LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

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DOCKET NO. 3:22-cv-780-J-MMHJBT	DATE FILED July 15, 2022	U.S. DISTRICT COURT Middle District of Florida
PLAINTIFF NEO WIRELESS, LLC		DEFENDANT MERCEDES-BENZ USA, LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	January 23, 2020	Neo Wireless LLC
2 10,833,908	June 16, 2020	Neo Wireless LLC
3 10,075,941	January 23, 2020	Neo Wireless LLC
4 10,447,450	January 23, 2020	Neo Wireless LLC
5 10,965,512	September 4, 2020	Neo Wireless
6 10,771,302	January 23, 2020	Neo Wireless LLC

CLERK ELIZABETH M. WARREN	(BY) DEPUTY CLERK Amy Thomas	DATE July 20, 2022
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DOCKET NO. 3:22-cv-01252	DATE FILED 7/15/2022	U.S. DISTRICT COURT Northern District of Ohio
PLAINTIFF Neo Wireless LLC		DEFENDANT FCA US, LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT Conditional Transfer Order (CTO 1) by the Judicial Panel on Multidistrict Litigation. In re: MDL 3034 Neo Wireless, LLC, Patent Litigation. Case Transferred to Eastern District of Michigan and assigned to the Honorable Terrence G. Berg.

CLERK Sandy Opacich	(BY) DEPUTY CLERK /s/Natalie Wlotzko	DATE 8/15/2022
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Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A
PATENT OR TRADEMARK

Page 2 of 2

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
6 10,965,512	3/30/2021	Neo Wireless LLC