IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
(DO/EO/US)

In Re the Application of:	Group Art Unit: Not Yet Assigned
KIM, et. al.	Confirmation No.: Not Yet Assigned
Serial No.: Not Yet Assigned	Examiner: Not Yet Assigned
Filed: Herewith	
IA Number: PCT/US2010/046088	**PRELIMINARY AMENDMENT**
IA Filing Date:	
20 August 2010 (20.08.2010)	**Filed Electronically**
Priority Date Claimed:	
21 August 2009 (21.08.2009)	
Atty. File No.: 5550-87-PUS	
Entitled: "HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS"	

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

Dear Sir:

Prior to the initial review of the above-identified patent application by the Examiner, please enter the following Preliminary Amendment. Although Applicants do not believe that any fees are due based upon the filing of this Preliminary Amendment, please charge any such fees to Deposit Account 19-1970.

Please amend the above-identified patent application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the Listing of Claims beginning on page 3 of this paper.

Remarks begin on page 10 of this paper.

INTEL-1002
9,584,262

AMENDMENT TO THE SPECIFICATION:

On page 1, immediately following the title, please add the following paragraph and subheading:

CROSS REFERENCE TO RELATED APPLICATION

This application is a national stage application under 35 U.S.C. 371 of PCT Application No. PCT/US2010/046088 having an international filing date of August 20, 2010, which designated the United States, which PCT application claimed the benefit of United States Application Serial No. 61/235,909, filed August 21, 2009, both of which are incorporated by reference in their entirety.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Original) An OFDM communication method comprising:

transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits; and

transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Currently Amended) The method of claim 1, further comprising modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols.

6. (Cancelled)

7. (Cancelled)

8. (Cancelled)

9. (Cancelled)

10. (Original) The method of claim 1, wherein a header of the second frame comprises a bit field that indicates the value for D.

11. (Currently Amended) The method of claim 1, wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value of D.

12. (Cancelled)

13. (Cancelled)

14. (Cancelled)

15. (Cancelled)

16. (Original) The method of claim 1, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

17. (Cancelled)

18. (Cancelled)

19. (Original) An OFDM transceiver capable of transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits and transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Cancelled)

24. (Currently Amended) ~~Claim 19 or 20~~The transceiver of claim 19, further comprising a modulation module capable of modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order.

25. (Cancelled)

26. (Cancelled)

27. (Cancelled)

28. (Cancelled)

29. (Currently Amended) ~~Claim 19 or 20~~The transceiver of claim 19, wherein a header of the second frame comprises a bit field that indicates the value for D.

30. (Currently Amended) ~~Claim 19 or 20~~The transceiver of claim 19, wherein the MAP frame is transmitted or received with a fixed value for D.

31. (Cancelled)

32. (Cancelled)

33. (Cancelled)

34. (Cancelled)

35. (Currently Amended) ~~Claim 19 or 20~~The transceiver of claim 19, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

36. (Cancelled)

37. (Cancelled)

38. (Original) An OFDM communication system comprising:

means for transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits; and

means for transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

39. (Cancelled)

40. (Cancelled)

41. (Cancelled)

42. (Currently Amended) The system of claim 38, further comprising means for modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols.

43. (Cancelled)

44. (Cancelled)

45. (Cancelled)

46. (Cancelled)

47. (Original) The system of claim 38, wherein a header of the second frame comprises a bit field that indicates the value for D.

48. (Currently Amended) The system of claim 38, wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value for D.

49. (Cancelled)

50. (Cancelled)

51. (Cancelled)

52. (Cancelled)

53. (Original) The system of claim 38, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

54. (Cancelled)

55. (Cancelled)

56. (Currently Amended) A non-transitory computer-readable information storage media having processor-executable instructions stored thereon that, if executed by a processor, are capable of performing the steps in ~~any one or more of claims 1-18~~ claim 1.

57. (Cancelled)

58. (Cancelled)

59. (Cancelled)

60. (New) The method of claim 1, wherein the transmitting or receiving is performed by a transceiver including an ASIC.

61. (New) The method of claim 1, wherein the transmitting or receiving is performed by a transceiver including a digital signal processor.

62. (New) The system of claim 19, wherein the OFDM transceiver includes an ASIC.

63. (New) The system of claim 19, wherein the OFDM transceiver includes a digital signal processor.

64. (New) The system of claim 38, wherein the means for transmitting or receiving includes an ASIC.

65. (New) The system of claim 38, wherein the transmitting or receiving includes a digital signal processor.

REMARKS/ARGUMENTS

The above amendments are being submitted in connection with the filing of the present Application. The amendments eliminate the multiple dependent claims from the Application, to reduce excess claims fees and to format the claims according to conventional U.S. practice.

Applicants believe that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecute and/or expedite allowance, the Examiner is invited to contact the undersigned.

Respectfully submitted,

SHERIDAN ROSS P.C.

By: _____

Jason H. Vick
Registration No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202-5141
(303) 863-9700

Date: 7 Dec 11

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae KIM
Filer:	Jason Vick/Yvonne Carter
Attorney Docket Number:	5550-87-PUS

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
National Stage Fee	1631	1	380	380
Natl Stage Search Fee - Report provided	1642	1	490	490
National Stage Exam - all other cases	1633	1	250	250
Pages:				
Claims:				
Claims in excess of 20	1615	2	60	120
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1240**

Electronic Acknowledgement Receipt

EFS ID:	11569145
Application Number:	13376856
International Application Number:	PCT/US10/46088
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae KIM
Customer Number:	62574
Filer:	Jason Vick/Yvonne Carter
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	08-DEC-2011
Filing Date:	
Time Stamp:	09:55:49
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1240
RAM confirmation Number	10222
Deposit Account	191970
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Documents submitted with 371 Applications	371_Transmittal_FINAL.pdf	504058 ac1f487a606b0cb3ff1b64d9d234ff79c1874b7c	no	4
Warnings:					
Information:					
2	Application Data Sheet	ADS.pdf	1424629 5f182d66e8322b15cc2aeb4550f782950201dcca	no	5
Warnings:					
Information:					
3		Preliminary_Amendment_FINAL.pdf	471700 f460ae50f920e9aceea61974a8303b870d324c51	yes	9

Multipart Description/PDF files in .zip description

Document Description	Start	End
Preliminary Amendment	1	1
Specification	2	2
Claims	3	8
Applicant Arguments/Remarks Made in an Amendment	9	9

Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	36857 0594bb9e7c9accc36637923cba8275211db2aa80	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2437244	

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.

PTO-1390 (09-11)
Approved for use through 4/30/2013. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
5550-87-PUS	

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US2010/046088	20 AUGUST 2010 (20.08.2010)	21 AUGUST 2009 (21.08.2009)

TITLE OF INVENTION
HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

APPLICANT(S) FOR DO/EO/US
Joon Bae KIM and Marcos C. TZANNES

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☑ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected (Article 31).
5. ☑ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☑ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☑ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☑ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☑ A preliminary amendment.
14. ☑ An Application Data Sheet under 37 CFR 1.76.
15. ☐ A substitute specification.
16. ☐ A power of attorney and/or change of address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821- 1.825.
18. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

This collection of information is required by 37 CFR 1.414 and 1.491-1 .492. The information is required to obtain or retain a b enefit by the public, w hich is to file (and by the USPTO to pro cess) 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 15 minutes to complete, including gathering information, preparing, and submitting the completed 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 FEE S OR COMPLE TED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
	PCT/US2010/046088	5550-87-PUS

20. Other items or information:

The following fees have been submitted	CALCULATIONS	PTO USE ONLY
21. ☑ Basic national fee (37 CFR 1.492(a)) **$380**	$ 380.00	
22. ☑ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)..... **$0** All other situations..... **$250**	$ 250.00	
23. ☑ Search fee (37 CFR 1.492(b)) If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)..... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority..... **$120** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB..... **$490** All other situations..... **$620**	$ 490.00	
TOTAL OF 21, 22 and 23 =	1,120.00	

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)).
The fee is **$310** for each additional 50 sheets of paper or fraction thereof.

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round **up** to a whole number)	RATE	
0 - 100 =	0 /50 =	0	x $310	$ 0

Surcharge of **$130.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	22 - 20 =	2	x $ 60	$120.00	
Independent claims	3 - 3 =	0	x $250	$0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $450	$ 0	
			TOTAL OF ABOVE CALCULATIONS =	$1,240.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by ½.					
			SUBTOTAL =	$ 1,240.00	
Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). +				$	
			TOTAL NATIONAL FEE =	$ 1,240.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
			TOTAL FEES ENCLOSED =	$ 1,240.00	
			Amount to be refunded:	$	
			Amount to be charged	$1,240.00	

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.

a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☑ Please charge my Deposit Account No. 19-1970 in the amount of $ 1,240.00 to cover the above fees.

c. ☑ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-1970.

d. ☐ Fees are to be charged to a credit card. **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. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended paying fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

SHERIDAN ROSS P.C.
1560 Broadway
Suite 1200
Denver, Colorado 80202
UNITED STATES

SIGNATURE

Jason H. Vick
NAME

45,285
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.

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. 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	5550-87-PUS
	Application Number	
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

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.)

Applicant Information:

Applicant 1 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Joon	Bae	KIM	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Lexington	State/Province	MA	Country of Residence[i]	US

Citizenship under 37 CFR 1.41(b)[i] KR

Mailing Address of Applicant:

Address 1	14 Pine Knoll Road		
Address 2			
City	Lexington	State/Province	MA
Postal Code	02420	Country[i]	US

Applicant 2 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Marcos	C.	TZANNES	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Orinda	State/Province	CA	Country of Residence[i]	US

Citizenship under 37 CFR 1.41(b)[i] US

Mailing Address of Applicant:

Address 1	121 La Espiral		
Address 2			
City	Orinda	State/Province	CA
Postal Code	94563	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.**

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5550-87-PUS
	Application Number	
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

Customer Number	62574		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS		
Attorney Docket Number	5550-87-PUS	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	8	Suggested Figure for Publication (if any)	1

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:

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	a 371 of international	PCT/US2010/046088	2010-08-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/US2010/046088	non provisional of	61/235909	2009-08-21

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5550-87-PUS
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Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

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If the Assignee is an Organization check here. ☒			
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First Name	Jason H.	Last Name	VICK	Registration Number	45285

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5550-87-PUS
	Application Number	
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

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(54) **Title**: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

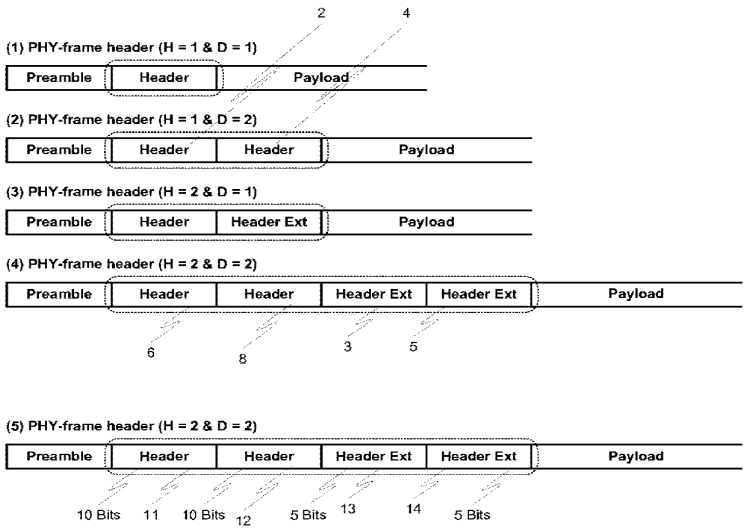


Fig. 1

(57) **Abstract**: An OFDM communication system is described that allows different values of D in a single domain where nodes are operating in different portions of frequency bands. For the power-line medium, G.9960 has defined two overlapped baseband bandplans, 50MHz-PB and 100MHz-PB. In this exemplary scenario, the level of frequency diversity is different depending on the bandplan, hence providing different header decodibility if D is fixed to 1. If D is fixed to 2, then it increases reliability for the narrowband devices, but may also unnecessarily increase overhead for the wide-band devices. An exemplary aspect is therefore directed to techniques to accommodate different repetitions schemes (D = 1,..., DMAX and H = I,..., H_{MAX}) in a single domain, and still allow devices to communicate with one another where D_{MAX} and H_{MAX} can be larger than 2.

WO 2011/022593 A1

HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

RELATED APPLICATION DATA

[0001] This application claims the benefit of and priority under 35 U.S.C. §119(e) to U.S. Patent Application No. 61/235,909, filed August 21, 2009, entitled "Header Repetition Scheme in Packet-Based OFDM Systems," which is incorporated herein by reference in its entirety.

FIELD

[0002] An exemplary aspect of this invention relates to communications systems. More specifically, exemplary methods, systems, means, protocols and computer-readable storage media, are directed toward header repetition in a communications environment.

BACKGROUND

[0003] Conventional multi-user communications system use frame-based (or packet-based) transmission to communication between two or more users over a shared channel based on Orthogonal Frequency Division Multiplexing (OFDM) – (OFDM is also sometimes referred to as multicarrier modulation.) A packet is usually formed by a preamble, header, and payload, and transmitted using time-sharing or contention-based media access methods. An example of such a system includes IEEE 802.11 (Wireless LAN), IEEE 802.16 (WiMAX), and ITU G.9960 (G.hn). These systems use OFDM transmission, which is also sometimes referred to as Discrete Multi-Tone (DMT) which divides the transmission frequency band into multiple subcarriers (also referred to as tones or sub-channels), with each sub-carrier individually modulating a bit or a collection of bits.

[0004] The header contains important control information for the receiver to decode the payload properly, and also provides information about the packet length for virtual carrier sensing. Hence, it is essential to decode the header reliably. In G.9960, which is incorporated herein by reference in its entirety, and should be familiar to those skilled in the art, the header containing PHY_H bits (header information block) is carried over one or two OFDM symbols (D = 1 or 2), and within each symbol, multiple header information blocks are repeated over the entire frequency band. (See Editor for G.9960, "ITU-T Recommendation G.9960: Next generation wire-line based home networking

transceivers – Foundation," ITU-T SG15/Q4, Jan. 2009) The default value of D is 1, but expanding it to 2 in some cases is under discussion. See, for example, "G.hn: PHY-Frame Header Extension," ITU Temporary Document ITU-T SG-15/Q4 09CC-046, August 2009, and ITU Temporary Document ITU-T SG15/Q4 09XC-100 entitled "G.hn: Using Two Symbols for the Header of PHY Frame on Coax," July, 2009, filed in the priority application and incorporated herein by reference in their entirety.

[0005] The possibility of carrying more than PHY_H bits in the header (H = 1 or 2) is also under discussion as disclosed in the "G.hn: PHY-Frame Header Extension" article and in "G.hn: Extended PHY Frame Header," ITU-T SG15/Q4 09XC-119, July 2009, filed in the priority application and incorporated herein by reference in their entirety.

SUMMARY

[0006] One exemplary technique discussed herein is allowing different values of D in a single domain where nodes are operating in different portions of frequency bands. For the power-line medium, G.9960 has defined two overlapped baseband bandplans, 50MHz-PB and 100MHz-PB. The possibility of having narrower bandplans such as 25MHz-PB and 12.5MHz-PB are under discussion in order to support, for example, SmartGrid applications.

[0007] In this exemplary scenario, the level of frequency diversity is different depending on the bandplan, hence providing different header decodability if D is fixed to 1. If D is fixed to 2, then it increases reliability for the narrowband devices, but may also unnecessarily increase overhead for the wide-band devices.

[0008] An exemplary aspect is therefore directed to techniques to accommodate different repetitions schemes (D = 1, ..., D_{MAX} and H = 1, ..., H_{MAX}) in a single domain, and still allow devices to communicate with one another. D_{MAX} and H_{MAX} can be 2 or larger than 2.

[0009] As illustrated in Fig. 1, various header repetition schemes are illustrated where D, H = 1 or 2. In Fig. 1, the second instance of a block with the same label is a copy of the prior block. The modulation of the copied block may not be exactly the same as the original version. For example, the label "Header Ext" emphasizes the fact that it may contain different header information than the "Header." The payload after the header may be omitted in some cases (e.g., ACK, RTS/CTS, etc.).

[0010] The repetition scheme expands similarly with larger values of D_{MAX} and H_{MAX}. An exemplary aspect focuses on dealing with different values of D, with different values of H capable of being supported in a straightforward way as discussed in the paper G.hn: PHY-Frame Header Extension.

[0011] On exemplary aspect is directed toward receiver detection of D with variable repetition. More specifically, in accordance with this exemplary embodiment, the transmitter selects (or determines), the at least one D value. The selection may be at its own discretion, or may be based on information communicated between one or more receivers, or based on instruction(s) from one or more other receivers and/or a domain master. Selection may depend on the number of available sub-carriers (or the bandwidth) of the bandplan the transmitter operates on and/or the receiver(s) operates on. In accordance with this exemplary embodiment, a receiving node in the domain should be able to decode packets sent by the transmitter without knowing D a priori (i.e. prior to decoding the packet header).

[0012] Another exemplary aspect is for a transmitter to carry, insert or otherwise communicate the value of D in the header so that all nodes know how many OFDM symbols are carrying header information. The receiver(s) starts processing the header by decoding one OFDM header symbol. If the receiver decodes it successfully, then the receiver knows how many more OFDM symbols (D-1) are carrying header information for a given frame. If the receiver fails to obtain the header information from the OFDM header symbol (i.e., the header decoding fails), then the receiver can try to decode two OFDM header symbols, and so on. The decoding of each additional OFDM header symbol provides additional diversity thereby increasing the likelihood of decoding the header information correctly.

[0013] Another exemplary aspect is directed to a fixed repetition scheme per domain. More specifically, a domain master can select (or determine) one or more fixed D values for at least one node in the domain. For example, the domain master may select one fixed value for all nodes in a domain. Selection may depend on the number of available sub-carriers (or the bandwidth) of the bandplans that the domain members operate on. The domain master may change the value of D dynamically. A node in the domain first needs to determine the D that the domain master has set (or selected/determined).

[0014] On exemplary aspect is for the domain master to carry, insert or otherwise

communicate the selected value of D in the header of the MAP frame while also using this D value for the transmission of the MAP header as described above. In this case, a node will be able to determine the value of D using the methods described above. After this value is determined by a node, the node can use this value until it is changed or updated by, for example, a domain master, another transceiver, etc.

[0015] Another exemplary aspect is for the domain master to carry, insert or otherwise communicate the selected value of D in the MAP while using a fixed D for the header of the MAP frame (e.g., pre-defined per medium or D_{MAX}). The D value in the MAP will be used for non-MAP frames/packets. In this case, a node in the domain may not need multiple levels of header decode process as described in above. Also in this exemplary method, the MAP may be sent with a different D value than the D value used for other (non-MAP) frames/packets.

[0016] Another exemplary aspect is directed toward a fixed repetition scheme per TXOP.

[0017] More specifically, in addition, or alternatively, the domain master may select (or determine) a D value per TXOP. This selection may be at its own discretion, or based on information communicated between one or more transceivers or receivers, or based on instruction from one or more transceivers or receivers. Selection may depend on the number of available sub-carriers (and/or the bandwidth) of the bandplan the transmitter/transceiver operates on and/or the receiver(s) operates on.

[0018] An exemplary technique is to include D in the TXOP descriptor transmitted in the MAP so that all nodes know in advance what value of D is used for that TXOP. The TXOP descriptor is the part of the MAP message which can be communicated via the MAP frame as discussed above.

[0019] Any of the above aspects and further aspects may be located in a network management system or network operation device that is located inside or outside the network and/or the transceiver(s). The network operation or management device that is located inside or outside the network may be managed and/or operated by a user, consumer, service provider or power utility provider, a governmental entity, or the like.

BRIEF DESCRIPTION ON THE DRAWINGS

[0020] The exemplary embodiments of the invention will be described in detail, with

reference to the following figures, wherein:

[0021] Fig. 1 illustrates exemplary header repetition schemes;

[0022] Fig. 2 illustrates an exemplary transceiver;

[0023] Fig. 3 illustrates an exemplary communications environment;

[0024] Fig. 4 is a flowchart outlining an exemplary method of a header repetition scheme;

[0025] Fig. 5 is a flowchart outlining another exemplary method for a header repetition scheme;

[0026] Fig. 6 is a flowchart outlining yet another exemplary method for a header repetition scheme;

[0027] Fig. 7 is a flowchart outlining another exemplary method for a header repetition scheme; and

[0028] Fig. 8 is a flowchart outlining another method of an exemplary header repetition scheme.

DETAILED DESCRIPTION

[0029] The exemplary embodiments of this invention will be described in relation to communications systems, as well as protocols, techniques and methods for header repetition, such as in a DSL or multimode multicarrier communications environment, a home network or an access network, or in general any communications network operating using any communications protocol(s). Examples of such home or access networks include home powerline networks, access powerline networks, home coaxial cable network, access coaxial cable network, wireless home networks, wireless corporate networks, home telephone networks and access telephone networks. However, it should be appreciated that in general, the systems, methods, and techniques of this invention will work equally well for other types of communications environments, networks, and/or protocols.

[0030] The exemplary systems and methods of this invention will also be described in relation to wired or wireless modems and/or a software and/or a hardware testing module, a telecommunications test device, or the like, such as a DSL modem, an ADSL modem, and xDSL modem, a VDSL modem, a line card, a G.hn transceiver, a MOCA transceiver, a Homeplug® transceiver, a power line modem, a wired or wireless modem,

test equipment, a multicarrier transceiver, a wireless wide/local area network system, a satellite communications system, a network-based communications systems, such as an IP, Ethernet or ATM system, a modem equipped with diagnostic capabilities, or the like, or a separate programmed general purpose computer having a communications device that is capable of operating in conjunction with any one or more of the following communications protocols: MOCA, Homeplug, IEEE 802.11, IEEE 802.3, IEEE 802.16 (WiMAX), and ITU G.9960 (G.hn), or the like. However, to avoid unnecessarily obscuring the present invention, the following description omits well-known structures, operations and devices that may be shown in block diagram form or are otherwise summarized or known.

[0031] For purposes of explanation, numerous details are set forth in order to provide a thorough understanding of the present invention. It should be appreciated however that the present invention may be practiced in a variety of ways beyond the specific details set forth herein. Furthermore, while the exemplary embodiments illustrated herein show various components of this system collocated, it is to be appreciated that the various components of the system can be located at distant portions of a distributed network, such as a communications network, node, within a Domain Master, and/or the internet, or within a dedicated secured, unsecured, and/or encrypted system and/or within a network operation or management device that is located inside or outside the network. As an example, a Domain Master can also be used to refer to any device, system or module that manages and/or configures any one or more aspects of the network or communications environment.

[0032] Thus, it should be appreciated that the components of the system can be combined into one or more devices, or split between devices, such as a modem, a station, a Domain Master, a network operation or management device, a node or collocated on a particular node of a distributed network, such as a communications network. As will be appreciated from the following description, and for reasons of computational efficiency, the components of the system can be arranged at any location within a distributed network without affecting the operation thereof. For example, the various components can be located in a Domain Master, a node, a domain management device, such as a MIB, a network operation or management device, or some combination thereof. Similarly, one or more of the functional portions of the system could be distributed between a

modem and an associated computing device/system, and/or in a dedicated test and/or measurement device.

[0033] Furthermore, it should be appreciated that the various links 5, including the communications channel(s) connecting the elements can be wired or wireless links or any combination thereof, or any other known or later developed element(s) capable of supplying and/or communicating data to and from the connected elements. The term module as used herein can refer to any known or later developed hardware, software, firmware, or combination thereof, that is capable of performing the functionality associated with that element. The terms determine, calculate, and compute and variations thereof, as used herein are used interchangeable and include any type of methodology, process, technique, mathematical operational or protocol. The terms transceiver and modem are also used interchangeably herein. The terms transmitting modem and transmitting transceiver as well as receiving modem and receiving transceiver are also used interchangeably herein.

[0034] The term management interface is related to any type of interface between a management entity and/or technician and/or user and a transceiver, such as, a CO-MIB or CPE-MIB as described, for example, in ITU standard G.997.1, which is incorporated herein by reference in its entirety.

[0035] Moreover, while some of the exemplary embodiments described herein are directed toward a transmitter portion of a transceiver performing certain functions, this disclosure is intended to include corresponding receiver-side functionality in both the same transceiver and/or another transceiver, and vice versa.

[0036] Fig. 1 illustrates four different header configurations where D, H, = 1 or 2. Even more specifically, in the first example, H=1 and D=1 with a preamble followed by a header followed by a payload. In a second example H=1 and D=2, with the preamble followed by header 2 that is repeated as header 4, which is followed by the payload. As discussed, the repeated header can be repeated in full or in part. In the third example, H=2 and D=1, such that the preamble is followed by a header which is followed by an extended header and the payload. In the fourth example, H=2 and D=2 such that header 6 is repeated as header 8, and the extended header 3 is repeated as extended header 5, which is followed by the payload. As discussed, the repeated portions may be exact duplicates.

[0037] As a more specific example, consider the header configuration in the fifth example. In the fifth example, H is again equal to 2 and D is equal to 2 such that header 11 is repeated as header 12, and the extended header 13 is repeated as extended header 14, which is followed by the payload. For this example, the "Header" is limited to a certain number of bits (here arbitrarily illustrated as 10 bits), however, for this example, there are 15 bits of information that need to be included in the header. Thus, 10 bits are included in the "Header" and the remaining 5 bits are included in the "Header Ext." As will be appreciated, the number of information bits to be included in the header, the number of bits the header is capable of carrying and the number of bits the header extended is capable of carrying can be any value(s). The 10 bits in "Header" 11 are repeated in "Header" 12 and the 5 bits in "Header Ext" 13 and repeated in "Header Ext" 14.

[0038] Fig. 2 illustrates an exemplary transceiver or Domain Master 200. In addition to well known componentry, the transceiver or Domain Master 200 includes (for a Domain Master) a MAP determination module 210 and (for a transceiver) a MAP processing or relaying module 210, a header assembly module 220, modulation module 230, demodulation module 240, transmitter 250, encoding module 260, decoding module 270, receiver 280, and controller/processor 290. In general, a Domain Master generally determines a MAP frame for transmission to one or more other transceivers while a transceiver is capable of one or more of receiving and/or relaying the received MAP frame to one or more other transceivers. For ease of discussion, in the following description, the determining and transmitting of a MAP frame will be performed by a Domain Master-type of transceiver and the receiving and/or relaying of a MAP frame will be performed by a non-domain master type of transceiver. However, the description also allows and enables any transceiver (Domain master or non-domain master) to determine, transmit, receiver and/or relay MAP messages.

[0039] In operation, the transceiver or Domain Master 200, cooperating with the MAP determination module or MAP processing or relaying module 210, transmitter 250, and controller/processor 290 transmits a MAP frame that includes a TXOP descriptor. As discussed, this TXOP descriptor contains a bit field that indicates a value for an integer (D) where the integer D indicates a number of header OFDM symbols that carry header bits. Next, the transceiver or Domain Master 200, cooperating with the header assembly

module 220 and transmitter 250 prepares to transmit a second frame having a plurality of header bits using the D header OFDM symbols. Each OFDM symbol carries the plurality of header bits. Then, in cooperation with the modulation module 230, the transceiver or Domain Master 200 modulates the header bit onto the D OFDM symbols. As discussed, this modulation of the header bits onto the D OFDM symbols can occur where the header bits are modulated onto the D OFDM symbols in the same order or can occur where the header bits are modulated onto the D OFDM symbols in a different order. In addition, the encoding module 260 may encode the value of D into a bit field on the header of the second frame. The second frame is then transmitted over the communications channel.

[0040] As discussed, the value of D can be updated based, for example, on information received from another transceiver, on information received from a domain master, can be initiated by the controller/processor 290, or can in general be initiated and/or requested by any other device, wherein the value of D that is updated is different than the previous value of D. With the updated value of D, the above-described steps can be repeated utilizing this updated value of D.

[0041] In accordance with another exemplary operational embodiment, the transceiver or Domain Master 200 transmits a MAP frame that includes the TXOP descriptor and then receives a second frame that has a plurality of header bits that use the D header OFDM symbols. This is followed by the demodulation module 240 demodulating the header bits from the D OFDM symbols that were received. Additionally, the decoding module 270 may decode the value of D from a bit field in the header of the received second frame. As with the previous embodiment, the value of D can be updated with the above steps being repeated.

[0042] In accordance with yet another exemplary operational embodiment, the transceiver 200 first receives the MAP frame that includes the TXOP descriptor with the cooperation of the receiver 280. The transceiver 200, with the cooperation of the header assembly module 220, and transmitter 250, transmits a second frame having a plurality of header bits using the D header OFDM symbols. As with the previous embodiments, the header bits are modulated onto the D OFDM symbols either the same or in a different order, and the value of D may be encoded in a bit field in the header of the second frame. Again, this can be followed by an updated value of D with the above steps

being repeated.

[0043] In yet another exemplary operational embodiment, the transceiver 200 receives a MAP frame that includes the TXOP descriptor, which is followed by the receipt of a second frame that has a plurality of header bits that used the D header OFDM symbols. As with one of the above exemplary embodiments, this is done with the cooperation of the receiver 280, the demodulation module 240 and decoding module 270. Upon receipt, the header bits from the D OFDM symbols can be demodulated and the value of D from a bit field in the header of the second frame may be decoded.

[0044] Fig. 3 illustrates an exemplary communications environment that includes a first transceiver or domain master 310 and a second transceiver 320. While not illustrated in Fig. 3, there could be one or more additional transceivers that act as relays to pass the various informational messages and data exchanged between the transceivers to thereby facilitate communication between the first transceiver or domain master 310 and the second transceiver 320.

[0045] In operation, the transceiver and/or domain master 310, cooperating with the MAP determination module or MAP processing or relaying module 210, transmitter 250, and controller/processor 290 transmits a MAP frame that includes a TXOP descriptor over the communications channel to the second transceiver 320. As discussed, this TXOP descriptor contains a bit field that indicates a value for an integer (D) where the integer D indicates a number of header OFDM symbols that carry header bits. Next, the transceiver/domain master 310, cooperating with the header assembly module 220 and transmitter 250 prepares to transmit a second frame to transceiver 320 having a plurality of header bits using the D header OFDM symbols. Each OFDM symbol carries the plurality of header bits. Then, in cooperation with the modulation module 230, the transceiver/domain master 310 modulates the header bit onto the D OFDM symbols. As discussed, this modulation of the header bits onto the D OFDM symbols can occur where the header bits are modulated onto the D OFDM symbols in the same order or can occur where the header bits are modulated onto the D OFDM symbols in a different order. In addition, the encoding module 260 may encode the value of D into a bit field on the header of the second frame. The second frame is then transmitted over the communications channel to the second transceiver 320.

[0046] As discussed, the value of D can be updated based, for example, on

information received from another transceiver, on information received from a domain master, can be initiated by the controller/processor 290, or can in general be initiated and/or requested by any other device, wherein the value of D that is updated is different than a previous value of D. With the updated value of D, the above-described steps can be repeated utilizing this updated value of D.

[0047] In accordance with another exemplary operational embodiment, the transceiver/domain master 310 transmits a MAP frame that includes the TXOP descriptor to the second transceiver 320 and then receives from the second transceiver 320 a second frame that has a plurality of header bits that use the D header OFDM symbols. This is followed by the transceiver/domain master's 310 demodulation module 240 demodulating the header bits from the D OFDM symbols that were received. Additionally, the decoding module 270 of the transceiver/domain master 310 decodes the value of D from the bit in the header of the received second frame. As with the previous embodiment, the value of D can be updated with the above steps being repeated.

[0048] In accordance with yet another exemplary operational embodiment, the transceiver/domain master 310 first receives the MAP frame that includes the TXOP descriptor from the second transceiver 320 with the cooperation of the receiver 280 in the transceiver/domain master 310. The transceiver/domain master 310, with the cooperation of the header assembly module 220, and transmitter 250, transmits a second frame having a plurality of header bits using the D header OFDM symbols to the second transceiver 320. As with the previous embodiments, the header bits are modulated onto the D OFDM symbols either the same or in a different order, and the value of D encoded in a bit field in the header of the second frame. Again, this can be followed by an updated value of D with the above steps being repeated.

[0049] In yet another exemplary operational embodiment, the transceiver/domain master 310 receives a MAP frame from the transceiver 320 that includes the TXOP descriptor, which is followed by the receipt of a second frame that has a plurality of header bits that used the D header OFDM symbols. As with one of the above embodiments, this is done with the cooperation of the receiver 280, the demodulation module 240 and decoding module 270. Upon receipt, the header bits from the D OFDM symbols can be demodulated and the value of D from a bit field in the header of the

second frame decoded. Again, this can be followed by an updated value of D with the above steps being repeated.

[0050] Fig. 4 illustrates an exemplary method of packet transmission. In particular, control begins in step S400 and continues to step S410. In step S410, a MAP frame is transmitted, with the MAP frame including a TXOP descriptor. As discussed, the TXOP descriptor can contain a bit field that indicates a value for an integer (D) wherein the integer D indicates a number of header OFDM symbols that carry header bits. The TXOP descriptor could contain multiple bit fields that indicate more than a value for the integer D as well. Next, in step S420, a second frame is prepared for transmission, the second frame having a plurality of header bits using D header OFDM symbols. Then, in step S430, the value of D is encoded into a bit field in the header of the second frame. Control then continues to step S440.

[0051] In step S440, the header bits are modulated onto the D OFDM symbols in either the same order or in a different order. Then, in step S450, the second frame is transmitted with control continuing to step S460.

[0052] In step S460, the value of D can optionally be updated with steps S410-S450 being repeated. Control then continues to step S470 where the control sequence ends.

[0053] Fig. 5 illustrates an exemplary method of packet reception. In particular, control begins in step S500 and continues to step S510. In step S510, a MAP frame is received, with the MAP frame including a TXOP descriptor. As discussed, the TXOP descriptor contains a bit field that indicates a value for an integer (D) wherein the integer D indicates a number of header OFDM symbols that carry header bits. Next, in step S520, a second frame is received, the second frame having a plurality of header bits that used the D header OFDM symbols. Then, in step S530, the header bits are demodulated from the D OFDM symbols in the same order or in a different order. Control then continues to step S540.

[0054] In step S540, the value of D is decoded from a bit field in the header of the second frame. Then, in step S550, the value of D can optionally be updated with steps S510-S540 being repeated. Control then continues to step S560 where the control sequence ends.

[0055] Fig. 6 illustrates an exemplary method of packet communication. In particular, control begins in step S600 in a first transceiver or Domain Master and continues to step

S610. In step S610, a MAP frame is transmitted to a second transceiver, with the MAP frame including a TXOP descriptor. For the second transceiver, control begins in step S602 and continues to step S604 where the MAP frame including the TXOP descriptor is received.

[0056] Next, in step S620, a second frame is prepared for transmission and transmitted to the second transceiver, the second frame having a plurality of header bits using D header OFDM symbols. As discussed the header bits are modulated onto the D OFDM symbols with the TXOP descriptor containing a bit field that indicates a value for a integer (D) wherein the integer D indicates a number of header OFDM symbols that carry header bits. The TXOP descriptor could contain multiple bit fields that indicate more than a value for the integer D as well. Additionally, the header bits can be modulated onto the D OFDM symbols in the same order or in a different order and the value of D encoded into a bit field in the header of the second frame. Control for the first transceiver then continues to step S630 where the control sequence ends.

[0057] In step S606, the second frame is received, the second frame having the plurality of header bits that used the D header OFDM symbols. Then, in step S608, the header bits are demodulated from the D OFDM symbols in the same order or in a different order with control continuing to step S612.

[0058] In step S612, the value of D is decoded from the bit field in the header of the second frame. Then, in step S612, the value of D can optionally be updated with steps S610, S620 and S604-S612 being repeated. Control then continues to step S616 where the control sequence ends.

[0059] Fig. 7 illustrates an exemplary method of packet communication. In particular, control begins in step S700 in a first transceiver or Domain Master and continues to step S710. In step S710, a MAP frame is transmitted to a second transceiver, with the MAP frame including a TXOP descriptor. Control then continues to step S720 where the control sequence ends.

[0060] For the second transceiver, control begins in step S702 and continues to step S704 where after receipt of the MAP frame that includes the TXOP descriptor, a second frame is prepared by the second transceiver for transmission, the second frame having a plurality of header bits using D header OFDM symbols. Then, in step S706, the value of D is encoded into a bit field in the header of the second frame with control continuing to

step S708.

[0061] In step S708, the header bits are modulated onto the D OFDM symbols in the same order or in a different order. Then, in step S712, the second frame is transmitted with control continuing to step S714.

[0062] In step S714, the value of D can optionally be updated with steps S710 and S704-S712 being repeated. Control then continues to step S716 where the control sequence ends.

[0063] Fig. 8 illustrates another exemplary method of packet communication. In particular, control begins in step S800 in a first transceiver or Domain Master and continues to step S810. In step S810, a MAP frame is transmitted to a second transceiver, optionally being relayed by one or more other transceivers, with the MAP frame including a TXOP descriptor. Control then continues to step S820 where the control sequence ends. The relaying of one or more of the MAP frame and second frame as discussed herein is not limited to this specific embodiment, but could also occur in any of the other embodiments disclosed herein.

[0064] For the second transceiver, control begins in step S802 and continues to step S804 where the MAP frame that includes the TXOP descriptor is received. Next, in step S806 a second frame is prepared by the second transceiver for transmission, the second frame having a plurality of header bits using D header OFDM symbols. Then, in step S808, the value of D is encoded into a bit field in the header of the second frame with control continuing to step S812.

[0065] In step S812, the header bits are modulated onto the D OFDM symbols in the same order or in a different order. Then, in step S814, the second frame is transmitted with control continuing to step S816.

[0066] In step S816, the value of D can optionally be updated with steps S810 and S804-S814 being repeated using the updated value of D. Control then continues to step S818 where the control sequence ends.

[0067] As used herein the terms network and domain have the same meaning and are used interchangeably. Also, the terms receiver, receiving node and receiving transceiver have the same meaning and are used interchangeably. Similarly, the terms transmitter, transmitting node and transmitting transceiver have the same meaning and are used interchangeably. The terms transceiver and modem also have the same

meaning and are used interchangeably. While the term home network has been used in this description, the description is not limited to home networks but in fact applies also to any network, such as enterprise networks, business networks, or any network with a plurality of connected nodes. The terms transceiver, node and modem have the same meaning and are used interchangeably in the description. The term frame and packet have the same meaning and are used interchangeably in the description. The term header and PHY-frame header have the same meaning and are used interchangeably in the description.

[0068] The terms network and home network have the same meaning and are used interchangeably in the description. While the term Home network has been used in this description, the description is not limited to home networks but in fact applies also to any network, such as enterprise networks, business networks, or any network with a plurality of connected nodes.

[0069] While the above-described methods and systems can be described with respect to a port (or endpoint) in a network, they can also be implemented in a dedicated module such as a test or network optimization module. This dedicated module could be plugged into the network and act as a Domain Master or with the cooperation of the Domain Master could initiate the various measurement techniques, gather the measurements from the port(s) in the network, analyze the measurements and use the measured information to detect and diagnose problems in the network and/or to optimize or improve the performance of a network.

[0070] While the above-described flowcharts have been discussed in relation to a particular sequence of events, it should be appreciated that one or more changes to this sequence can occur without materially effecting the operation of the embodiments. Additionally, the exact sequence of events need not occur as set forth in the exemplary embodiments. The exemplary techniques illustrated herein are not limited to the specifically illustrated embodiments but can also be utilized with the other exemplary embodiments and each described feature is individually and separately claimable. Moreover, the steps in the flowcharts are optional, with some of or all of the steps being performed.

[0071] The above-described methods and systems and can be implemented in a software module, a software and/or hardware testing module, a telecommunications

test device, a DSL modem, an ADSL modem, an xDSL modem, a VDSL modem, a linecard, a G.hn transceiver, a MOCA transceiver, a Homeplug transceiver, a powerline modem, a wired or wireless modem, test equipment, a multicarrier transceiver, a wired and/or wireless wide/local area network system, a satellite communication system, network-based communication systems, such as an IP, Ethernet or ATM system, a modem equipped with diagnostic capabilities, or the like, or on a separate programmed general purpose computer having a communications device or in conjunction with any of the following communications protocols: CDSL, ADSL2, ADSL2+, VDSL1, VDSL2, HDSL, DSL Lite, IDSL, RADSL, SDSL, UDSL, MOCA, G.hn, Homeplug® or the like.

[0072] Additionally, the systems, methods and protocols of this invention can be implemented on a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a flashable device, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device such as PLD, PLA, FPGA, PAL, a modem, a transmitter/receiver, any comparable means, or the like. In general, any device (or one or more equivalent means) capable of implementing a state machine that is in turn capable of implementing the methodology illustrated herein can be used to implement the various communication/measurement methods, protocols and techniques according to this invention.

[0073] Furthermore, the disclosed methods may be readily implemented in software stored on a non-transitory computer-readable storage media using object or object-oriented software development environments that provide portable source code that can be used on a variety of computer or workstation platforms. Alternatively, the disclosed system may be implemented partially or fully in hardware using standard logic circuits or VLSI design. Whether software or hardware is used to implement the systems in accordance with this invention is dependent on the speed and/or efficiency requirements of the system, the particular function, and the particular software or hardware systems or microprocessor or microcomputer systems being utilized. The communication systems, methods and protocols illustrated herein can be readily implemented in hardware and/or software using any known or later developed systems or structures, devices and/or software by those of ordinary skill in the applicable art from the functional description provided herein and with a general basic knowledge of the

computer and telecommunications arts.

[0074] Moreover, the disclosed methods may be readily implemented in software that can be stored on a computer-readable storage medium, executed on programmed general-purpose computer with the cooperation of a controller and memory, a special purpose computer, a microprocessor, or the like. The systems and methods of this invention can be implemented as a program embedded on personal computer such as an applet, JAVA® or CGI script, as a resource residing on a server or computer workstation, as a routine embedded in a dedicated communication system or system component, or the like. The system can also be implemented by physically incorporating the system and/or method into a software and/or hardware system, such as the hardware and software systems of a test/modem device.

[0075] While the invention is described in terms of exemplary embodiments, it should be appreciated that any of the aspects of the invention described herein in connection with the exemplary embodiments could be separately and individually claimed and one or more of the features of the various embodiments can be combined with one or more features discussed in relation to one or more other embodiments.

[0076] While the exemplary embodiments illustrated herein discuss the various components collocated, it is to be appreciated that the various components of the system can be located a distant portions of a distributed network, such as a telecommunications network and/or the Internet or within a dedicated communications network. Thus, it should be appreciated that the components of the system can be combined into one or more devices or collocated on a particular node of a distributed network, such as a telecommunications network. As will be appreciated from the following description, and for reasons of computational efficiency, the components of the communications network can be arranged at any location within the distributed network without affecting the operation of the system.

[0077] It is therefore apparent that there has been provided, in accordance with the present invention, systems and methods for header repetition in OFDM systems. While this invention has been described in conjunction with a number of embodiments, it is evident that many alternatives, modifications and variations would be or are apparent to those of ordinary skill in the applicable arts. Accordingly, it is intended to embrace all such alternatives, modifications, equivalents and variations that are within the spirit and

scope of this invention.

Claims:

1. An OFDM communication method comprising:

transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits; and

transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

2. The method of claim 1, further comprising modulating the header bits onto the D OFDM symbols

3. The method of claim 1, further comprising demodulating the header bits from the D OFDM symbols

4. The method of claim 1, further comprising modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in the same order.

5. The method of claim 1, further comprising modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order.

6. The method of claim 1, further comprising demodulating the header bits from the D OFDM symbols, wherein the header bits were modulated onto the D OFDM symbols in a different order.

7. The method of claim 1, further comprising demodulating the header bits from the D OFDM symbols, wherein the header bits were modulated onto the D OFDM symbols in the same order.

8. The method of claim 1, further comprising encoding the value of D into a bit field in a header of the second frame.

9. The method of claim 1, further comprising decoding the value of D from a bit field in a header of the second frame.

10. The method of claim 1, wherein a header of the second frame comprises a bit field that indicates the value for D.

11. The method of claim 1, wherein the MAP frame is transmitted or received with a fixed value for D.

12. The method of claim 11, wherein the fixed value for D is equal to the maximum value for D.

13. The method of claim 1, wherein the plurality header bits of header bits in the D OFDM symbols are modulated or demodulated in the same order.

14. The method of claim 1, wherein the plurality header bits of header bits in the D OFDM symbols are modulated or demodulated in a different order.

15. The method of claim 1, wherein D can take on the values of 1 and 2.

16. The method of claim 1, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

17. The method of claim 1, further comprising updating the value of D contained in the TXOP descriptor, wherein the updated value of D is different than the original value of D.

18. The method of claim 17, wherein one or more of the steps in claims 2-16 are repeated with the updated value of D.

19. An OFDM transceiver capable of transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits and transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

20. An OFDM system comprising a first transceiver capable of transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits and a second transceiver capable of transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

21. Claim 19 or 20, further comprising a modulation module capable of modulating the header bits onto the D OFDM symbols

22. Claim 19 or 20, further comprising a demodulation module capable of demodulating the header bits from the D OFDM symbols

23. Claim 19 or 20, further comprising a modulation module capable of modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in the same order.

24. Claim 19 or 20, further comprising a modulation module capable of modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order.

25. Claim 19 or 20, further comprising a demodulation module capable of demodulating the header bits from the D OFDM symbols, wherein the header bits were modulated onto the D OFDM symbols in a different order.

26. Claim 19 or 20, further comprising a demodulation module capable of demodulating the header bits from the D OFDM symbols, wherein the header bits were modulated onto the D OFDM symbols in the same order.

27. Claim 19 or 20, wherein the value of D is encoded into a bit field in a header of the second frame.

28. Claim 19 or 20, wherein the value of D is decoded from a bit field in a header of the second frame.

29. Claim 19 or 20, wherein a header of the second frame comprises a bit field that indicates the value for D.

30. Claim 19 or 20, wherein the MAP frame is transmitted or received with a fixed value for D.

31. Claim 30, wherein the fixed value for D is equal to the maximum value for D.

32. Claim 19 or 20, wherein the plurality header bits of header bits in the D OFDM symbols are modulated or demodulated in the same order.

33. Claim 19 or 20, wherein the plurality header bits of header bits in the D OFDM symbols are modulated or demodulated in a different order.

34. Claim 19 or 20, wherein D can take on the values of 1 and 2.

35. Claim 19 or 20, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

36. Claim 19 or 20, wherein the value of D contained in the TXOP descriptor is updated, wherein the updated value of D is different than the original value of D.

37. Claim 36, wherein one or more of the steps in claims 21-35 are repeated with the updated value of D.

38. An OFDM communication system comprising:

means for transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits; and

means for transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, wherein each OFDM header symbol carries the plurality of header bits.

39. The system of claim 38, further comprising means for modulating the header bits onto the D OFDM symbols

40. The system of claim 38, further comprising means for demodulating the header bits from the D OFDM symbols

41. The system of claim 38, further comprising means for modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in the same order.

42. The system of claim 38, further comprising means for modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order.

43. The system of claim 38, further comprising means for demodulating the header bits from the D OFDM symbols, wherein the header bits were modulated onto the D OFDM symbols in a different order.

44. The system of claim 38, further comprising means for demodulating the header bits from the D OFDM symbols, wherein the header bits were modulated onto the D OFDM symbols in the same order.

45. The system of claim 38, further comprising means for encoding the value of D into a bit field in a header of the second frame.

46. The system of claim 38, further comprising means for decoding the value of D from a bit field in a header of the second frame.

47. The system of claim 38, wherein a header of the second frame comprises a bit field that indicates the value for D.

48. The system of claim 38, wherein the MAP frame is transmitted or received with a fixed value for D.

49. The system of claim 48, wherein the fixed value for D is equal to the maximum value for D.

50. The system of claim 38, wherein the plurality header bits of header bits in the D OFDM symbols are modulated or demodulated in the same order.

51. The system of claim 38, wherein the plurality header bits of header bits in the D OFDM symbols are modulated or demodulated in a different order.

52. The system of claim 38, wherein D can take on the values of 1 and 2.

53. The system of claim 38, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

54. The system of claim 38, further comprising means for updating the value of D contained in the TXOP descriptor, wherein the updated value of D is different than the original value of D.

55. The system of claim 54, wherein one or more of the steps in claims 39-53 are repeated with the updated value of D.

56. A non-transitory computer-readable information storage media having processor-executable instructions stored thereon that, if executed by a processor, are capable of performing the steps in any one or more of claims 1-18.

57. Claim 19, wherein the OFDM transceiver is a domain master.

58. Claim 20, wherein the first transceiver is a domain master.

59. Any one or more of the features as described herein.

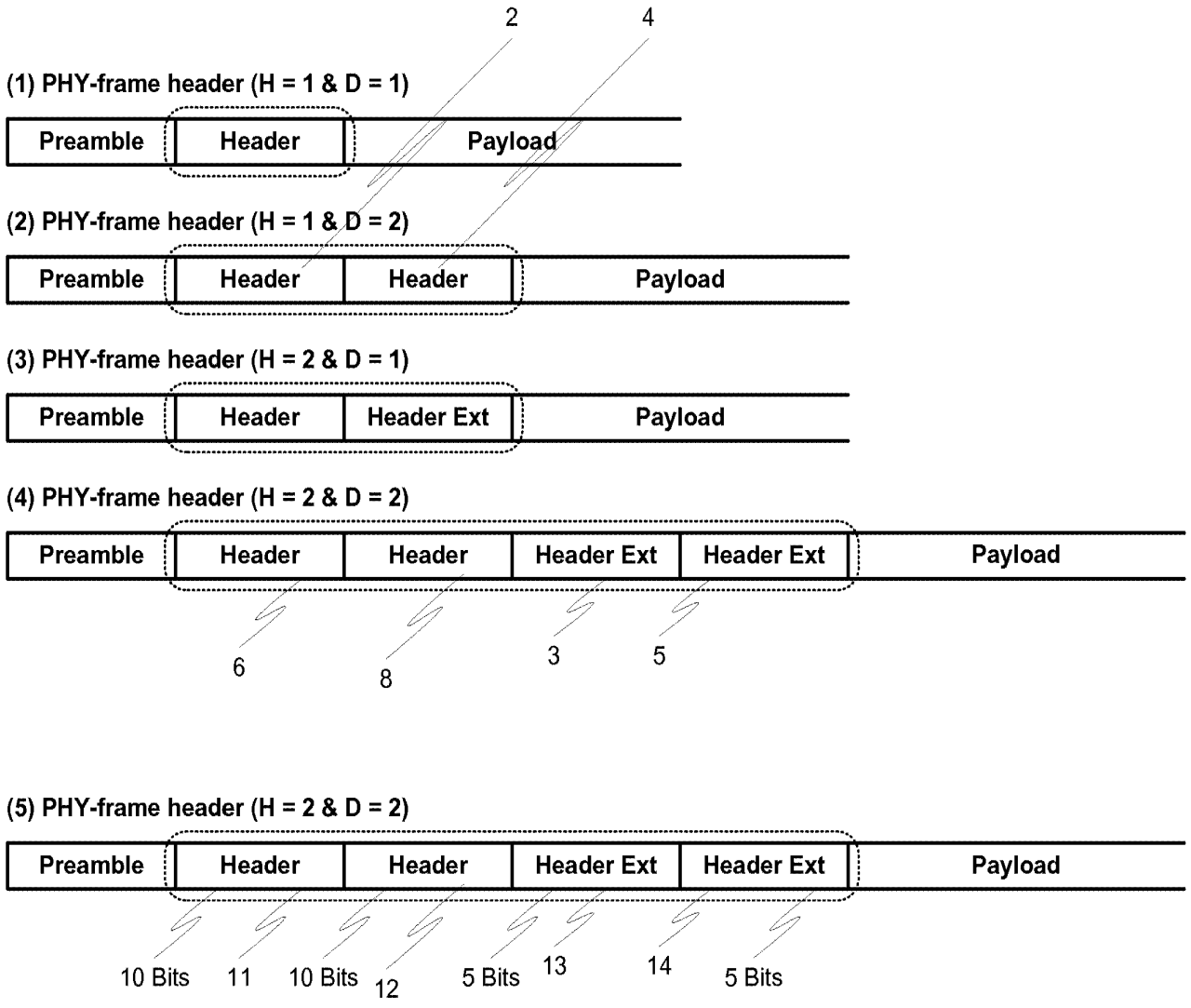

2
4
(1) PHY-frame header (H = 1 & D = 1)
Preamble
Header
Payload
(2) PHY-frame header (H = 1 & D = 2)
Preamble
Header
Header
Payload
(3) PHY-frame header (H = 2 & D = 1)
Preamble
Header
Header Ext
Payload
(4) PHY-frame header (H = 2 & D = 2)
Preamble
Header
Header
Header Ext
Header Ext
Payload
6
8
3
5
(5) PHY-frame header (H = 2 & D = 2)
Preamble
Header
Header
Header Ext
Header Ext
Payload
10 Bits
11
10 Bits
12
5 Bits
13
14
5 Bits

Fig. 1

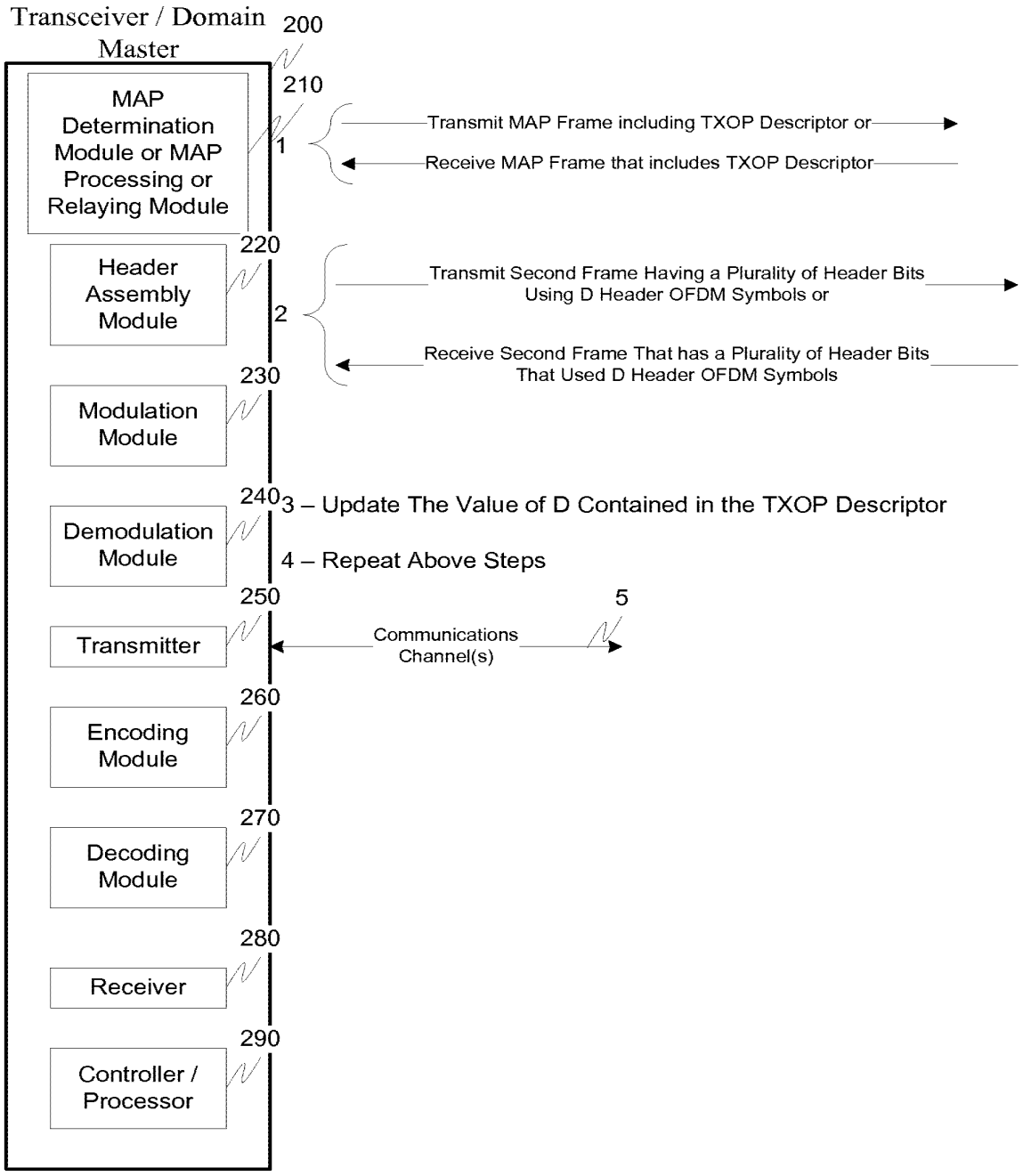

Transceiver / Domain Master
200
MAP Determination Module or MAP Processing or Relaying Module
210
1
Transmit MAP Frame including TXOP Descriptor or
Receive MAP Frame that includes TXOP Descriptor
Header Assembly Module
220
2
Transmit Second Frame Having a Plurality of Header Bits Using D Header OFDM Symbols or
Receive Second Frame That has a Plurality of Header Bits That Used D Header OFDM Symbols
Modulation Module
230
Demodulation Module
240
3 – Update The Value of D Contained in the TXOP Descriptor
4 – Repeat Above Steps
Transmitter
250
5
Communications Channel(s)
Encoding Module
260
Decoding Module
270
Receiver
280
Controller / Processor
290

Fig. 2

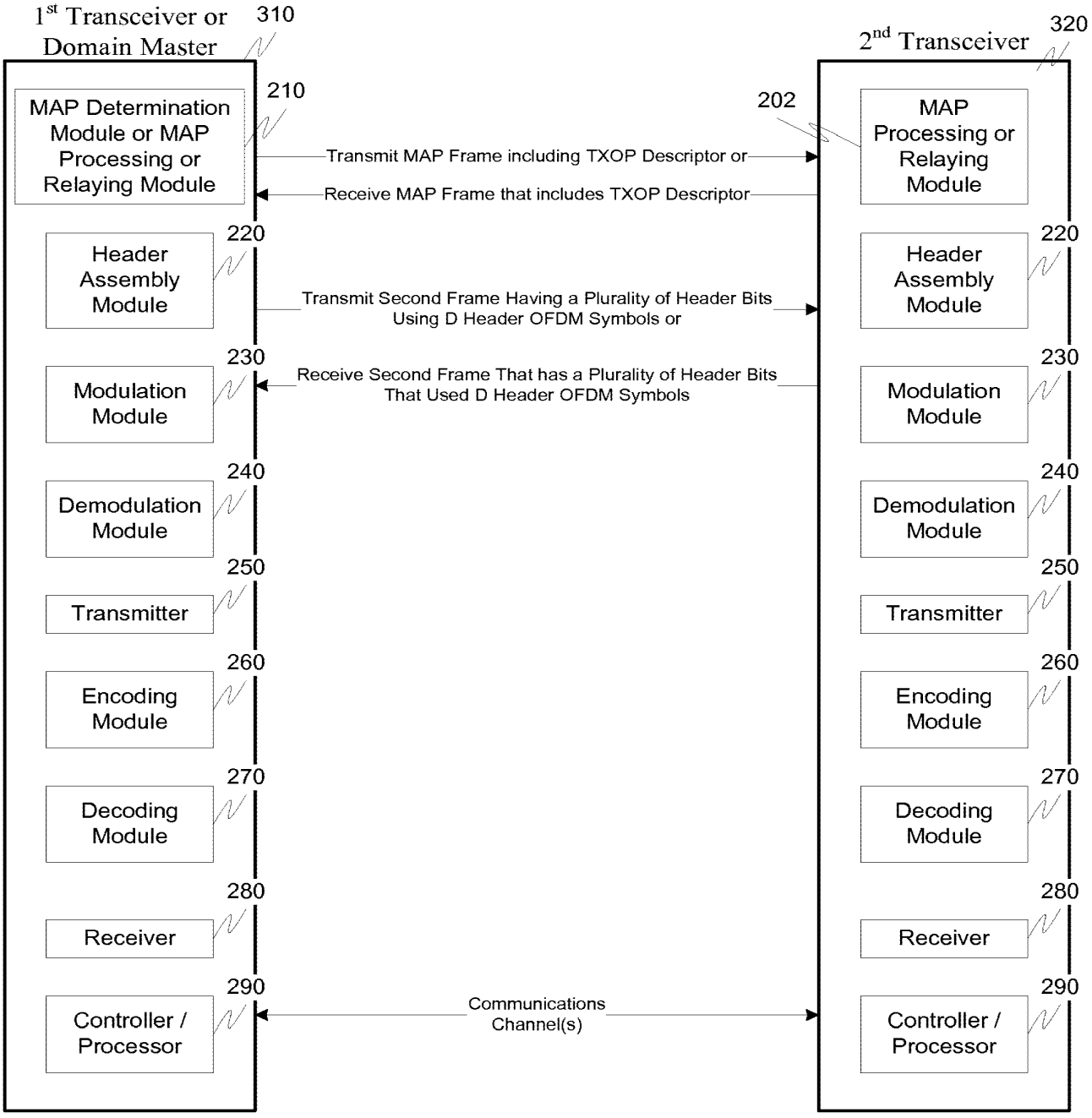

1st Transceiver or Domain Master
310
2nd Transceiver
320
MAP Determination Module or MAP Processing or Relaying Module
210
202
MAP Processing or Relaying Module
Transmit MAP Frame including TXOP Descriptor or
Receive MAP Frame that includes TXOP Descriptor
Header Assembly Module
220
Transmit Second Frame Having a Plurality of Header Bits Using D Header OFDM Symbols or
Modulation Module
230
Receive Second Frame That has a Plurality of Header Bits That Used D Header OFDM Symbols
Demodulation Module
240
Transmitter
250
Encoding Module
260
Decoding Module
270
Receiver
280
Controller / Processor
290
Communications Channel(s)

Fig. 3

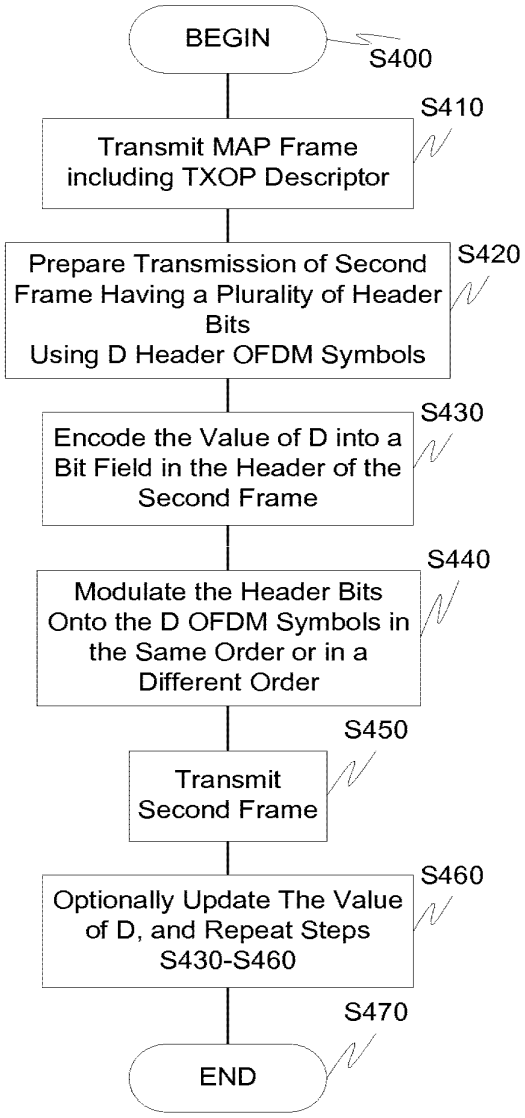

BEGIN
S400
S410
Transmit MAP Frame including TXOP Descriptor
Prepare Transmission of Second Frame Having a Plurality of Header Bits Using D Header OFDM Symbols
S420
S430
Encode the Value of D into a Bit Field in the Header of the Second Frame
S440
Modulate the Header Bits Onto the D OFDM Symbols in the Same Order or in a Different Order
S450
Transmit Second Frame
S460
Optionally Update The Value of D, and Repeat Steps S430-S460
S470
END

Fig. 4

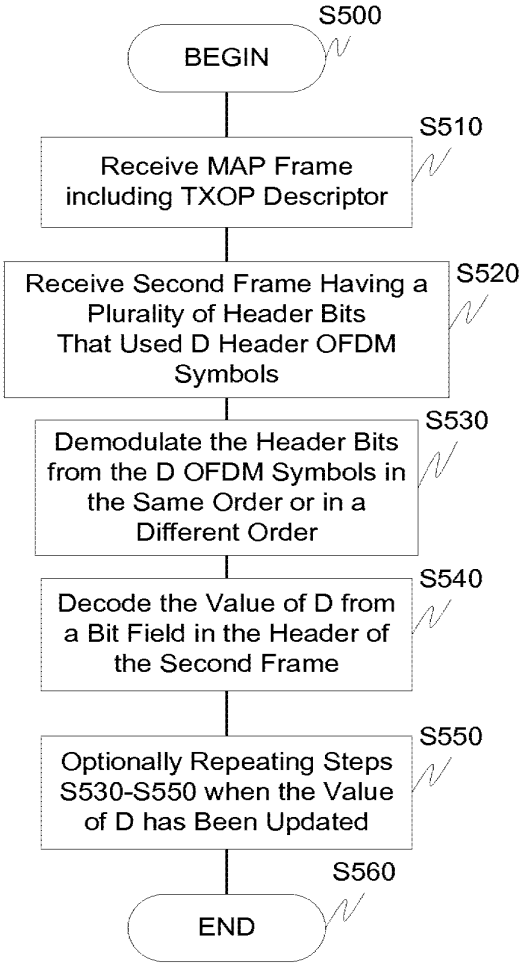

S500
BEGIN
S510
Receive MAP Frame including TXOP Descriptor
S520
Receive Second Frame Having a Plurality of Header Bits That Used D Header OFDM Symbols
S530
Demodulate the Header Bits from the D OFDM Symbols in the Same Order or in a Different Order
S540
Decode the Value of D from a Bit Field in the Header of the Second Frame
S550
Optionally Repeating Steps S530-S550 when the Value of D has Been Updated
S560
END

Fig. 5

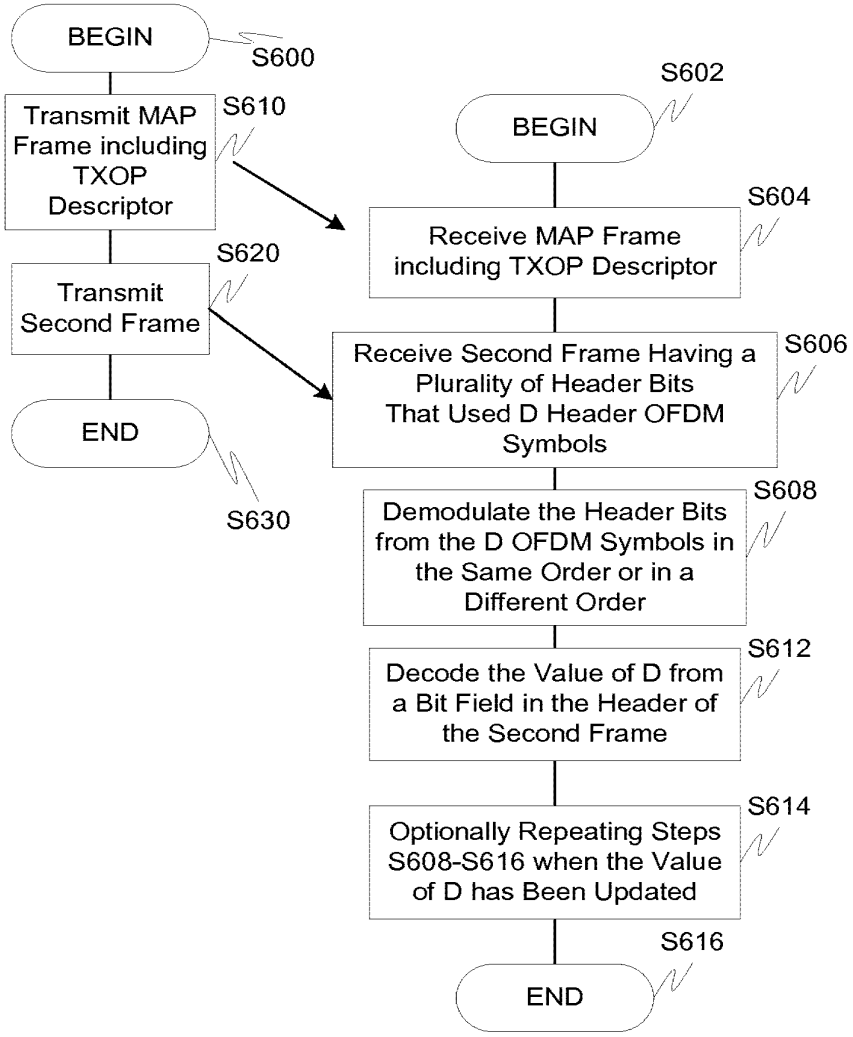

BEGIN
S600
Transmit MAP Frame including TXOP Descriptor
S610
Transmit Second Frame
S620
END
S630
S602
BEGIN
S604
Receive MAP Frame including TXOP Descriptor
S606
Receive Second Frame Having a Plurality of Header Bits That Used D Header OFDM Symbols
S608
Demodulate the Header Bits from the D OFDM Symbols in the Same Order or in a Different Order
S612
Decode the Value of D from a Bit Field in the Header of the Second Frame
S614
Optionally Repeating Steps S608-S616 when the Value of D has Been Updated
S616
END

Fig. 6

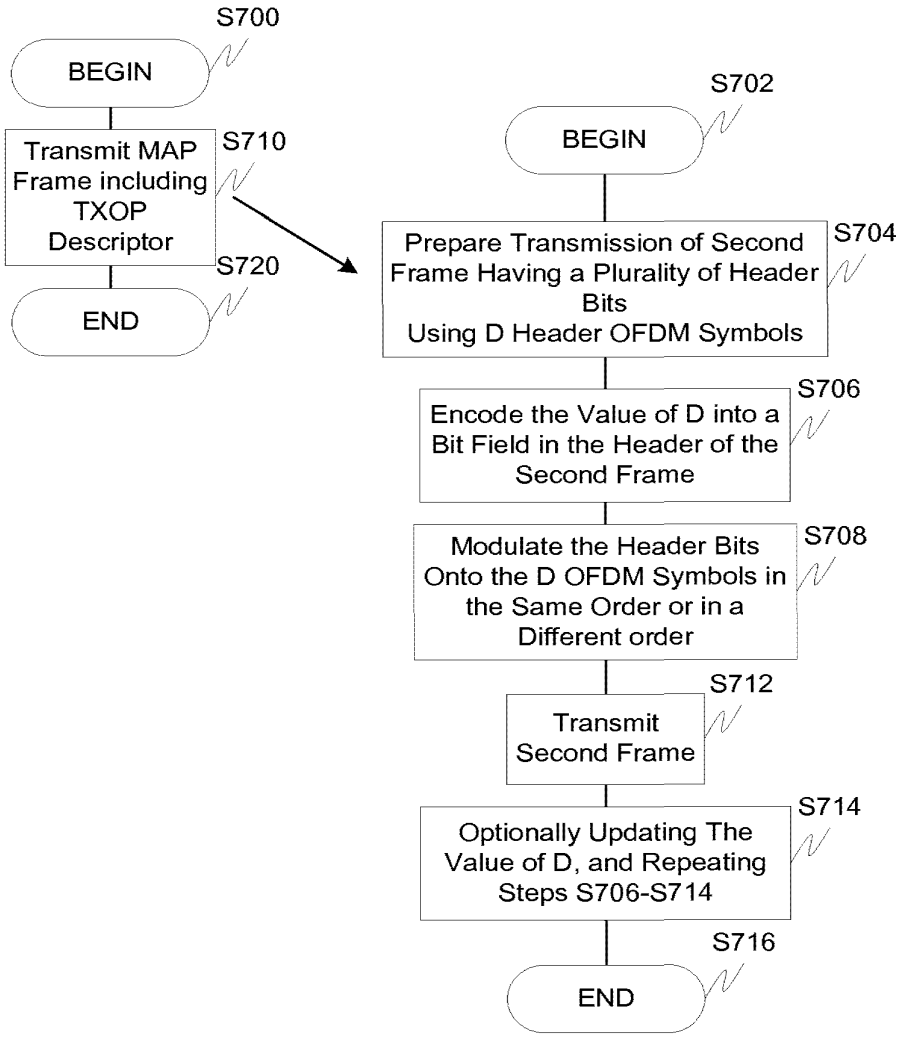

S700
BEGIN
Transmit MAP Frame including TXOP Descriptor
S710
S720
END
S702
BEGIN
Prepare Transmission of Second Frame Having a Plurality of Header Bits Using D Header OFDM Symbols
S704
Encode the Value of D into a Bit Field in the Header of the Second Frame
S706
Modulate the Header Bits Onto the D OFDM Symbols in the Same Order or in a Different order
S708
Transmit Second Frame
S712
Optionally Updating The Value of D, and Repeating Steps S706-S714
S714
END
S716

Fig. 7

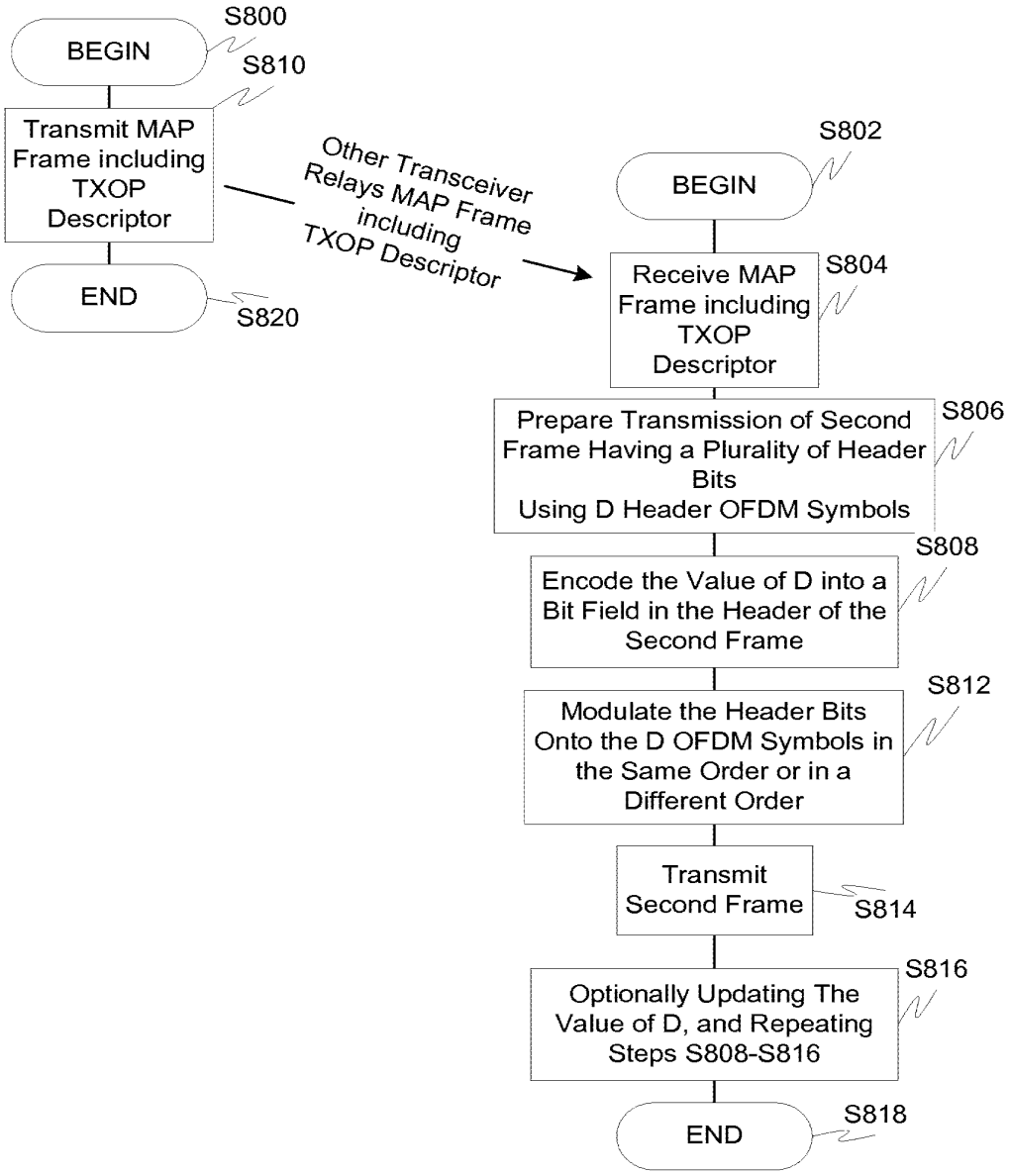

BEGIN
S800
S810
Transmit MAP Frame including TXOP Descriptor
END
S820
Other Transceiver Relays MAP Frame including TXOP Descriptor
BEGIN
S802
Receive MAP Frame including TXOP Descriptor
S804
Prepare Transmission of Second Frame Having a Plurality of Header Bits Using D Header OFDM Symbols
S806
Encode the Value of D into a Bit Field in the Header of the Second Frame
S808
Modulate the Header Bits Onto the D OFDM Symbols in the Same Order or in a Different Order
S812
Transmit Second Frame
S814
Optionally Updating The Value of D, and Repeating Steps S808-S816
S816
END
S818

Fig. 8

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FILING DATE: *August 21, 2009*
RELATED PCT APPLICATION NUMBER: *PCT/US10/46088*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US61/235,909*

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Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

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Inventor(s)

Inventor 1 — Remove

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

Title of Invention	Header Repetition Scheme in Packet-based OFDM Systems
Attorney Docket Number (if applicable)	5550-87-PROV

Correspondence Address

Direct all correspondence to (select one):

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First Name	Jason H.	Last Name	Vick	Registration Number (If appropriate)	45285

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1 PROVISIONAL PATENT APPLICATION

Header Repetition Scheme in Packet-based OFDM Systems

2 INVENTORS

Joon Bae Kim
Marcos Tzannes

3 BRIEF OVERVIEW OF AN EXEMPLARY EMBODIMENT OF THE INVENTION

This invention describes methods to facilitate nodes (devices) using different repetition schemes for their header transmission to communicate with one another in a single domain (network) in the presence of nodes operating on partial bandwidth (e.g., reduced sampling rate).

4 BACKGROUND

Conventional multi-user communication systems use frame-based (or packet-based) transmission to communicate between two or more users over a shared channel based on OFDM. A packet is usually formed by preamble, header, and payload, and transmitted using time-sharing or contention-based media access methods. The example of such system includes IEEE 802.11 (Wireless LAN), IEEE 802.16 (WiMAX), and ITU G.9960 (G.hn). These systems use OFDM transmission (also referred to sometimes as Discrete Multi-Tone (DMT)) which divides the transmission frequency band into multiple subcarriers (also referred to as tones or sub-channels), with each sub-carrier individually modulating a bit or a collection of bits.

The header contains important control information for the receiver to decode the payload properly, and also provides information about the packet length for virtual carrier sensing. Hence it is essential to decode the header reliably. In G.9960 the header containing PHY_H bits (header information block) is carried over one or two OFDM symbols ($D = 1$ or 2), and within each symbol, multiple header information blocks are repeated over the entire frequency band [1]. The default value of D is 1, but expanding it to 2 in some cases is under discussion [2, 3]. The possibility of carrying more than PHY_H bits in the header ($H = 1$ or 2) is also under discussion [2, 4].

5 TECHNICAL DESCRIPTION OF THE INVENTION

What has not been discussed is allowing different values of D in a single domain where nodes are operating in different portions of frequency bands. For the power-line medium, G.9960 has defined two overlapped baseband bandplans, 50MHz-PB and 100MHz-PB. The possibility of having narrower bandplans such as 25MHz-PB and 12.5MHz-PB are under discussion in order to support SmartGrid applications. In this scenario, the level of frequency diversity is different depending on the bandplan, hence provides different header decodibility if D is fixed to 1. If D is fixed to 2, then it increases

reliability for the narrow band devices, but unnecessarily increases overhead for the wide-band devices.

This invention describes methods to accommodate different repetition schemes ($D = 1, \ldots, D_{MAX}$ and $H = 1, \ldots, H_{MAX}$) in a single domain, and still allow devices to communicate with one another. D_{MAX} and H_{MAX} can be larger than 2.

5.1 Example of header repetition when D, H = 1 or 2

Figure 1 describes the header repetition scheme when D, H = 1 or 2.

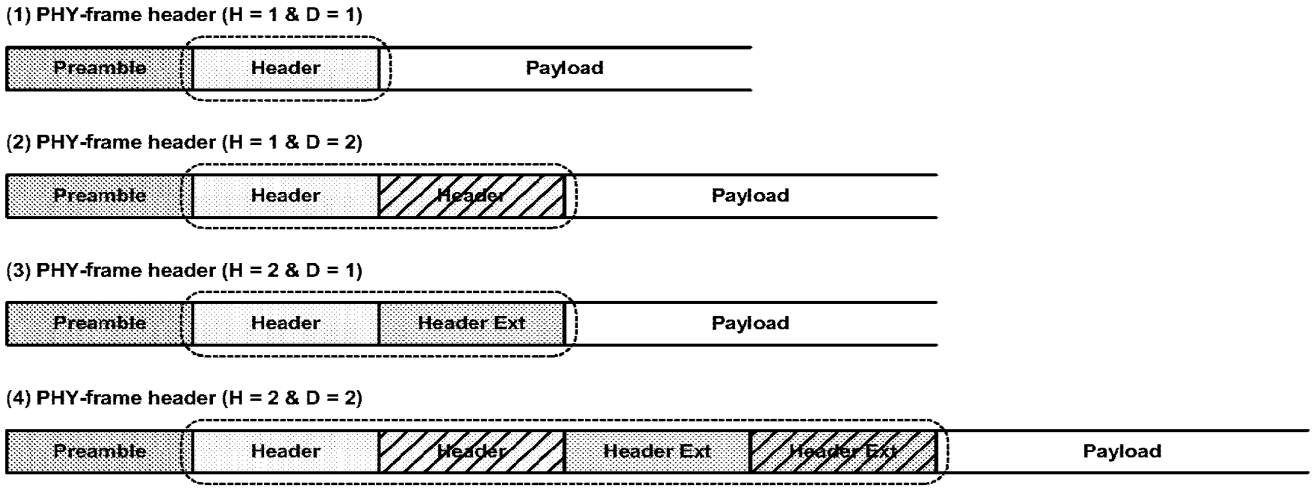


Figure 1: Header repetition scheme (D, H = 1 or 2)

The shaded block represents the copy of the unshaded block with the same label. The modulation of the copied block may not be exactly the same as its original version. The label "Header Ext" emphasizes the fact that it contains different header information than "Header". The payload after the header may be omitted in some cases (e.g., ACK, RTS/CTS). The repetition scheme expands similarly with larger values of D_{MAX} and H_{MAX}. The invention focuses on dealing with different values of D. Different values of H can be supported in straightforward way as proposed in [2].

5.2 Detection by receiver (variable repetition)

In this exemplary embodiment, the transmitter selects (or determines) at least one D value. This selection may be at its own discretion, or based on information communicated between one or more receivers, or based on instruction from one or more receivers. Selection may depend on the number of available sub-carriers (or the bandwidth) of the bandplan the transmitter operates on and/or the receiver(s) operates on. In this exemplary embodiment a receiving node in the domain should be able to decode packets sent by the transmitter without knowing D a priori (i.e. prior to decoding the packet header).

One exemplary method is for a transmitter to carry the value of D in the header so that all nodes know how many OFDM symbols are carrying header information. The receiver starts processing the header

by decoding one OFDM header symbol. If the receiver decodes it successfully, then it knows how many more OFDM symbols (*D-1*) carrying header information for a given frame. If the receiver fails to obtain header information out of one OFDM header symbol (i.e. the header decoding fails), then it can try to decode two OFDM header symbols, and so on. The decoding of each additional OFDM header symbol provides additional diversity thereby increasing the likelihood of decoding the header information correctly.

5.3 Fixed repetition scheme per domain

In one exemplary embodiment, the domain master selects (or determines) one or more fixed D values for at least one node in the domain. For example, the domain master may select one fixed value for all nodes in a domain. Selection may depend on the number of available sub-carriers (or the bandwidth) of the bandplans that the domain members operate on. The domain master may change the value of *D* dynamically. A node in the domain first needs to determine the *D* that the domain master has set (or selected/determined).

One exemplary method is for the domain master to carry the selected value of *D* in the header of the MAP frame while also using this D value for the transmission of the MAP header (as described in §5.1). In this case, a node will determine out this D value using the methods described in §5.1. After this value is determined by a node, the node will use this value until it is changed by the domain master.

Other exemplary method is for the domain master to carry the selected value of *D* in the MAP and while using a fixed *D* for the header of the MAP frame (e.g., pre-defined per medium or D_{MAX}). The D value in the MAP will be used for non-MAP frames/packets. In this case a node in the domain does not need multiple levels of header decode process (as described in §5.1). Also in this exemplary method, the MAP may be sent with a different D value than the D value used for other (non-MAP) frames/packets.

5.4 Fixed repetition scheme per TXOP

Additionally or alternately, the domain master may select (or determine) a *D* value per TXOP. This selection may be at its own discretion, or based on information communicated between one or more receivers, or based on instruction from one or more receivers. Selection may depend on the number of available sub-carriers (or the bandwidth) of the bandplan the transmitter operates on and/or the receiver(s) operates on.
One exemplary method is to include *D* in the TXOP descriptor transmitted in the MAP so that all nodes know in advance what values of *D* is used for that TXOP. TXOP descriptor is the part of the MAP message which can be communicated via the MAP frame as described in §5.2.

6 GENERAL TERMS

The terms *subcarrier*, *subchannel* and *tone* have the same meaning and are used interchangeably in the description.
The terms *receiver*, *receiving node* and *receiving transceiver* have the same meaning and are used interchangeably in the description.

The term *transmitter*, *transmitting node* and *transmitting transceiver* have the same meaning and are used interchangeably in the description.

The terms *transceiver* and *modem* have the same meaning and are used interchangeably in the description.

The term *frame* and *packet* have the same meaning and are used interchangeably in the description.

The term *header* and *PHY-frame header* have the same meaning and are used interchangeably in the description.

The terms *network* and *home network* have the same meaning and are used interchangeably in the description. While the term Home network has been used in this description, the description is not limited to home networks but in fact applies also to any network, such as enterprise networks, business networks, or any network with a plurality of connected nodes.

The above-described methods and systems and can be implemented in a software module, a software and/or hardware testing module, a telecommunications test device, a DSL modem, an ADSL modem, an xDSL modem, a VDSL modem, a linecard, a G.hn transceiver, a MOCA transceiver, a Homeplug transceiver, a powerline modem, a wired, a wireless modem such as 802.11a/g/n or 802.16, test equipment, a multicarrier transceiver, a wired and/or wireless wide/local area network system, a satellite communication system, network-based communication systems, such as an IP, Ethernet or ATM system, a modem equipped with diagnostic capabilities, or the like, or on a separate programmed general purpose computer having a communications device or in conjunction with any of the following communications protocols: CDSL, ADSL2, ADSL2+, VDSL1, VDSL2, HDSL, DSL Lite, IDSL, RADSL, SDSL, UDSL, MOCA, G.hn, Homeplug or the like.

Additionally, the systems, methods and protocols of this invention can be implemented on a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a flashable device, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device such as PLD, PLA, FPGA, PAL, a modem, a transmitter/receiver, any comparable means, or the like. In general, any device capable of implementing a state machine that is in turn capable of implementing the methodology illustrated herein can be used to implement the various communication methods, protocols and techniques according to this invention. While the systems and means disclosed herein are described in relation to various functions that are performed, it is to be appreciated that the systems and means may not always perform all of the various functions, but are capable of performing one or more of the disclosed functions.

Furthermore, the disclosed methods may be readily implemented in software using object or object-oriented software development environments that provide portable source code that can be used on a variety of computer or workstation platforms. Alternatively, the disclosed system may be implemented partially or fully in hardware using standard logic circuits or VLSI design. Whether software or hardware is used to implement the systems in accordance with this invention is dependent on the speed and/or efficiency requirements of the system, the particular function, and the particular software or hardware systems or microprocessor or microcomputer systems being utilized. The communication systems, methods and protocols illustrated herein can be readily implemented in hardware and/or software using any known or later developed systems or structures, devices and/or software by those of ordinary skill in the applicable art from the functional description provided herein and with a general basic knowledge of the computer and telecommunications arts.

Moreover, the disclosed methods may be readily implemented in software that can be stored on a computer-readable storage medium, executed on programmed general-purpose computer with the cooperation of a controller and memory, a special purpose computer, a microprocessor, or the like. In these instances, the systems and methods of this invention can be implemented as program embedded on personal computer such as an applet, JAVA® or CGI script, as a resource residing on a server or computer workstation, as a routine embedded in a dedicated communication system or system component, or the like. The system can also be implemented by physically incorporating the system and/or method into a software and/or hardware system, such as the hardware and software systems of a test/modeling device.

While the invention is described in terms of exemplary embodiments, it should be appreciated that individual aspects of the invention could be separately claimed and one or more of the features of the various embodiments can be combined.

While the systems and means disclosed herein are described in relation to various functions that are performed, it is to be appreciated that the systems and means may not always perform all of the various functions, but are capable of performing one or more of the disclosed functions.

While the exemplary embodiments illustrated herein discuss the various components collocated, it is to be appreciated that the various components of the system can be located a distant portions of a distributed network, such as a telecommunications network and/or the Internet or within a dedicated communications network. Thus, it should be appreciated that the components of the system can be combined into one or more devices or collocated on a particular node of a distributed network, such as a telecommunications network. As will be appreciated from the following description, and for reasons of computational efficiency, the components of the communications network can be arranged at any location within the distributed network without affecting the operation of the system.

It is therefore apparent that there has been provided, in accordance with the present invention, systems and methods for detecting unfiltered device(s). While this invention has been described in conjunction with a number of embodiments, it is evident that many alternatives, modifications and variations would be or are apparent to those of ordinary skill in the applicable arts. Accordingly, it is intended to embrace all such alternatives, modifications, equivalents and variations that are within the spirit and scope of this invention.

7 CLAIMS

1. A method for allowing different values of D in a single domain where nodes are operating in different portions of frequency bands.

2. A method to accommodate different repetition schemes ($D = 1, \ldots, D_{MAX}$ and $H = 1, \ldots, H_{MAX}$) in a single domain, and still allow devices to communicate with one another. D_{MAX} and H_{MAX} can be larger than 2.

8 REFERENCE

[1] Editor for G.9960, "ITU-T Recommendation G.9960: Next generation wire-line based home networking transceivers – Foundation," *ITU-T SG15/Q4*, Jan. 2009.

[2] Aware, "G.hn: PHY-Frame Header Extension," *ITU-T SG15/Q4 09CC-046*, Concord, California, Aug. 2009.

[3] CopperGate, "G.hn: Using Two Symbols for the Header of a PHY frame on Coax," *ITU-T SG15/Q4 09XC-100*, Xian, China, Jul. 2009.

[4] Intellon, "G.hn: Extended PHY frame header," *ITU-T SG15/Q4 09XC-119*, Xian, China, Jul. 2009.

Electronic Acknowledgement Receipt	
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Application Number:	61235909
International Application Number:	
Confirmation Number:	1550
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First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
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1	Provisional Cover Sheet (SB16)	PROV_Cover_Sheet.pdf	1000376 f36ad4a3a883de80a71e3a1a05699d6e343caefb	no	3
Warnings:					
Information:					
2	Specification	Specificationv3.pdf	768521 3628b92da039c676ec5c810a5e640e3d98c9122e	no	126
Warnings:					
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3	Fee Worksheet (PTO-875)	fee-info.pdf	29280 1f212f36f7ab032ea17056800a805bc847d65dda	no	2
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ITU - Telecommunication Standardization Sector Temporary Document 09CC-046

STUDY GROUP 15 Original: English

Concord, California, 24 – 28 August 2009

Question: 4/15

SOURCE[1]: Aware

TITLE: **G.hn: PHY-Frame Header Extension**

ABSTRACT

This contribution proposes a generic PHY-frame header extension scheme to incorporate larger than PHY_H bits in the header (Issue 5.0.1.2.1.0.13). It also proposes not to fix the number of header repetitions (D) unconditionally for any given medium since the wide range of bandplans shall be accommodated effectively in a single domain (Issue 5.0.1.2.1.2.0.1).

| Introduction | Proposal | Text Update | Summary |

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1 Introduction

The group has been discussing PHY-frame header extension in two different aspects, (1) increasing the number of information bits carried in the PHY-frame header, and (2) repeating the same header information over two OFDM symbols for enhanced diversity combination. We need to have a generic and consistent approach to accomplish these two goals.

In 09CV meeting the group agreed to specify a scheme to extend the PHY-frame header so that larger than PHY_H bits can be accommodated in the PHY-frame header (Issue 5.0.1.2.1.0.13). This contribution proposes a generic scheme to extend the PHY-frame header. The proposed scheme makes G.hn future-proof, and it can be immediately used to support bi-directional transmission proposed by [4].

Item Number	Status	Item Description	Reference(s)
5.0.1.2.1.0.13	Agreed 8-Apr-09	That G.hn shall specify means to extend the PHY-frame header.	09CV-042

In 09XC meeting the group provisionally agreed that the number of PHY-frame header repetitions (D) shall be set to 2 in the coax medium since the number of available sub-carriers in coax 50MHz bandplan (256) is not enough to guarantee the reliability of PHY-frame header (Issue 5.0.1.2.1.2.0.1).

Item Number	Status	Item Description	Reference(s)
5.0.1.2.1.2.0.1	Agreed 30-July-09	Provisionally, that the value of D shall be 2 for the coax medium (baseband and RF) subject to there not being any alternative proposal submitted by the upload deadline for the Q4/15 G.hn meeting August 2009.	09XC-100

2 Proposal

For extending the capability of carrying more than PHY_H bits in the PHY-frame header, we propose the followings:

- ❑ Add a bit (Extended Header Indication: EHI) in the original PHY-frame header fields (Table 7-1) to indicate whether or not the header extension is applied.

- ❑ Define a generic field description for the extended part of the header in §7.1.2.3.3 (new section), which is also PHY_H bits long, and contains the common part (e.g., E_HCS) and variable part (e.g., E_FTSF).

The text update is proposed in the following section.

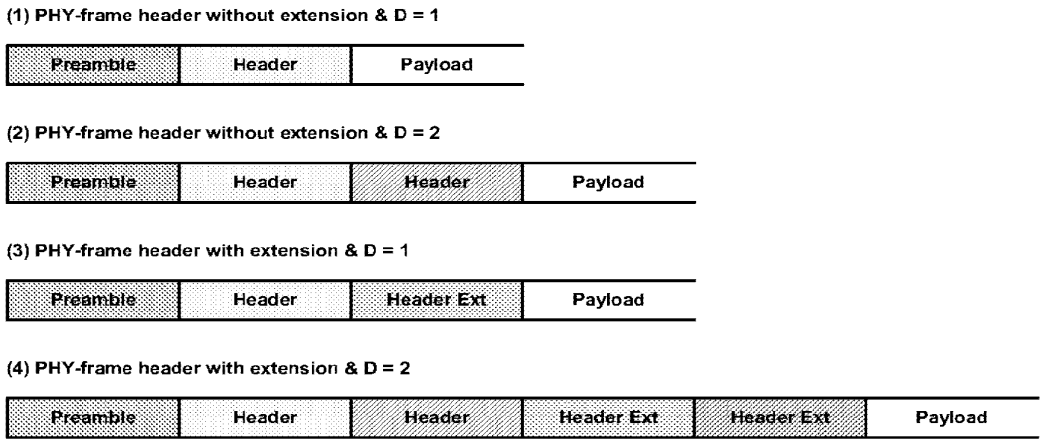
For specifying the number of PHY-frame header repetitions (D), we propose not to fix D per medium, rather to define a technique to use different values of D. Although it is understood that more repetitions may be necessary in coax, fixing D unconditionally for any given medium is neither a flexible nor an efficient solution because

- ❑ Even in the power line medium we may face the similar situation as narrower bandplans are added to support SmartGrid applications (Issue 1.90.10.1). In this case we need a flexible scheme to support narrow and wide bandplans at the same time.

Item Number	Status	Item Description	Reference(s)
1.90.10.1	Agreed 31-July-09	That G.hn shall specify: • Extensions to support the Smart Grid applications • A profile that is applicable to Smart Grid for devices that need to satisfy the requirements in terms of data rate, QoS, power consumption and device complexity.	09CX-104

- ❑ Applying $D = 2$ uniformly for all bandplans in coax makes G.hn less efficient for wide bandplans (e.g., 200MHz-CRF) as well as over the legacy system.

The possible cases of PHY-frame header transmissions are shown in the following figure.



3 Text Update

3.1 Existing text update for G.9960 Amendment 1

Text is updated based on [3] with all changes accepted.

<Start of text>

7.1.2.3 PHY-frame header

The core part of the PHY-frame header is PHY_H bits long and is composed of a common part and a variable part. The common part contains fields that are common for all PHY-frame types. The variable part contains fields according to the PHY-frame type. PHY-frame type is indicated by the FT field. The PAD fields fit the length of the header of different PHY frame-types to the standard values of PHY_H bits. The content of the ~~header~~ core part is protected by the 16-bit header check sequence (HCS).

The fields of the core part of the PHY-frame header are defined in Table 7-1.

Depending on the frame type, the PHY-frame header may be extended to $2 \times PHY_H$ bits long. If the extended header indication (EHI) bit is set, then additional PHY_H information bits of the extended part of the PHY-frame header are appended at the end of the core part of the PHY-frame header. The extended part of the PHY-frame header shall be encoded exactly the same way as the core part as described in §7.1.3.4.

Table 7-1/G.9960 – Core part of PHY-frame header fields

Field	Octet	Field Size [Bits]	Description	
FT	0	4	Frame type	Common part
DOD	0	4	Domain ID	
SID	1	8	The device ID of the source node	
DID	2	8	The device ID of the destination node(s)	
MI	3	1	Multicast indication identifies whether the DID is a multicast destination	
PHI	3	1	Post header indication identifies whether the first payload symbol after the header is a PRBS symbol or a data symbol	
EHI	3	1	Extended header indication	
Reserved	3	56	Reserved by ITU-T	
Duration	4-5	16	The PHY frame transmission duration	
…	6-18			Variable part
HCS	19-20	16	Header check sequence	Common part

<End of text>

3.2 New text for G.9960 Amendment 1

Text is added based on [3] with all changes accepted.

<Start of text>

7.1.2.3.1.6 Post Header Indication (PHI)

The PHI bit, when set, shall indicate that the first payload symbol following the header is a PRBS symbol. Otherwise the first payload symbol shall be a data symbol.

7.1.2.3.1.7 Extended Header Indication (EHI)

The EHI field, when set, shall indicate that the PHY frame header contains $2\times PHY_H$ information bits. The additional PHY_H information bits of the extended part of the PHY-frame header are specified in §7.1.2.3.3. If the EHI field is zero, then the PHY-frame header shall contain PHY_H information bits. The EHI field shall be set according to the frame type.

<End of text>

<Start of text>

7.1.2.3.3 Extended header fields

The extended part of the PHY-frame header is PHY_{β} bits long and is composed of a common part and a variable part. The common part contains fields that are common for all PHY-frame types. The variable part contains fields according to the PHY-frame type. PHY-frame type is indicated by the FT field in the core part of the PHY-frame header. The PAD fields fit the length of the header of different PHY frame-types to the standard values of PHY_{β} bits. The content of the extended part is protected by the 16-bit header check sequence (E_HCS).

The fields of the extended part of the PHY-frame header are defined in Table 7-XY.

Table 7-XY/G.9960 – Extended part of PHY-frame header fields

Field	Octet	Field Size [Bits]	Description	
E_FTSF	0-18	152	Extended frame-type specific fields	Variable part
E_HCS	19-20	16	Extended header check sequence	Common part

7.1.2.3.3.1 Extended frame-type specific fields (E_FTSF)

This is for further study.

7.1.2.3.3.2 Extended header check sequence (E_HCS)

The E_HCS field is intended for verification of the extended part of the PHY-frame header. The E_HCS is a 16-bit cyclic redundancy check (CRC) and shall be computed over all the fields of the E_FTSF in the order they are transmitted, starting with the LSB of the first field and ending with the MSB of the last field of E_FTSF. The same polynomial described in §7.1.2.3.1.8 shall be used.

<End of text>

4 References

[1] Editor for G.hn, "G.hn: Draft Text for G.hn – version 4.1," *ITU-T SG15/Q4 09CC-R12*, Concord, California, Aug. 2009.

[2] Editor for G.hn, "G.hn: Updated Issues List for G.hn," *ITU-T SG15/Q4 09XC-U12R1*, Xian, China, Jul. 2009.

[3] Editor for G.hn, "ITU-T Recommendation G.9960 Unified high-speed wire-line based home networking transceivers - Foundation," *ITU-T SG15/Q4 G.9960 LC comment resolution draft text R8*, Concord, California, Aug. 2009.

[4] Intellon, "G.hn: Bi-directional transmissions," *ITU-T SG15/Q4 09XC-113R1*, Xian, China, Jul. 2009.

5 Summary

1. This paper proposes to agree on the following new issues.

Item Number	Status	Item Description	Reference(s)
5.0.1.2.1.0.13.1 (New)	Open	Should the following sections of text be revised or added to G.9960 Amendment 1 as working text: • §7.1.2.3 "PHY-frame header", • §7.1.2.3.1.7 "Extended Header Indication (EHI)", • §7.1.2.3.3 "Extended header fields", • §7.1.2.3.3.1 "Extended frame-type specific fields (E_FTSF)", and • §7.1.2.3.3.2 "Extended header check sequence (E_HCS)"?	09CC-046
5.0.1.2.1.0.13.2 (New)	Open	Should G.hn adopt the PHY-frame header extension scheme proposed in 09CC-046?	09CC-046
5.0.1.2.1.2.0.1.1 (New)	Open	Should the G.hn define a technique to use different values of D for any given medium rather than use a fixed value (response to the provisional agreement in Issue 5.0.1.2.1.2.0.1)?	09CC-046

ITU - Telecommunication Standardization Sector Temporary Document 09XC-100

STUDY GROUP 15 Original: English

Xian, China – 27 – 31 July 2009

Question: 4/15

SOURCE[1]: CopperGate Communications

TITLE: G.hn: Using Two Symbols for the Header of a PHY frame on Coax

ABSTRACT

The contribution proposes that the number of symbols used for the header of the PHY frame on coax (baseband and RF) be fixed to two exactly. The reason for this proposal is that a single symbol does not provide adequate reliability for the 50 MHz case, as shown below.

1. Introduction

The PHY-header of a PHY-frame is defined in G.9960 [1] to contain important information necessary in order to process the payload. The information of the header is encoded in a single FEC block of 168 bits with code rate 1/2. This information is modulated unto either one or two OFDM symbols using QPSK modulation. The effective number of repetitions depends on the number of active subcarriers and on the number of header symbols (1 or 2).

It is not specified what the conditions for choosing one or two symbols are. The intention is that there will be a sufficient number of repetitions of the FEC block so that some minimum level of robustness is guaranteed.

A straightforward calculation can be carried out in order to assess the required number of OFDM symbols. Let us consider the more challenging setting of 50 MHz devices on coax. Both for baseband and RF, the number of subcarriers is 256. Since the header is modulated using QPSK and rate 1/2 a single copy of the PHY-header FEC block takes 168 subcarriers. Obviously, there is only room for a single complete copy of the FEC block. This situation is problematic, because the header does not have any advantage over the payload in terms of robustness.

Decoding a 136-bit FEC block with a BLER level of 10^{-6} requires an SNR of 5 dB or so. On the other hand, decoding a 520-byte FEC block with a BLER level of 10^{-6} requires an SNR of about 3.5 dB – some 1.5 dB less.

It is reasonable to approximate that if there are N copies of a FEC block then it acquires an extra coding gain of $10\log_{10}(N)$, even if N is non integer. If we assume that 0.9 of the band is utilized then this means there are $256\times0.9/168 = 1.4$ repetitions per symbol, which provide a gain of 1.5 dB. This

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CopperGate Communications

makes the header about as robust as a payload encoded using a FEC block of 520 bytes with code rate 1/2 and QPSK modulation.

This contribution proposes to *always* use two header symbols on coax. The number of subcarriers in two OFDM symbols is 512, which is barely sufficient to accommodate 3 full copies of the header, which require 3×168 = 504 subcarriers. Note that in practice some guard bands are expected near the band edges. In this case, even 3 full repetitions will not fit in.

2. Proposal

It is proposed to incorporate the following text additions to [2] G.hn: Draft text for G.9960 Amendment 1 – version 4.0.

<<Start of Text>>

7.1.3.4 Header encoder

The functional model of the header encoder is presented in Figure 7-10. It contains an FEC encoder and a Header Repetition Encoder (HRE).

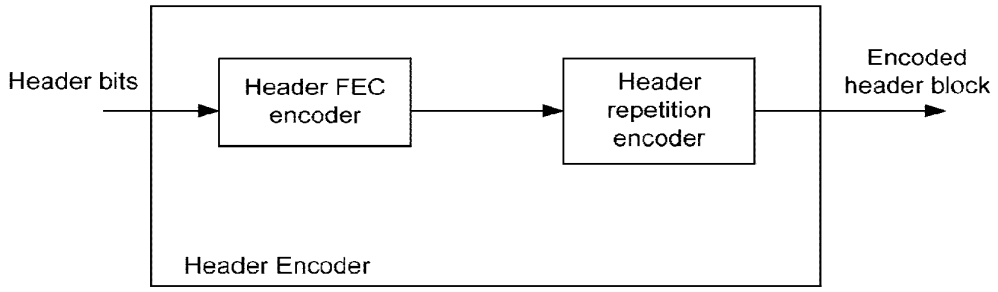


Figure 7-10/G.9960 – Functional diagram of the Header Encoder

The bits of the PHY-frame header shall input the Header FEC encoder in their original order and encoded as described in §7.1.3.2. The size of the FEC codeword and the coding rate of the Header FEC encoder are described in Table 7-19.

The FEC codeword enters the HRE. The HRE shall operate as follows:

- The FEC codeword shall be first copied M times, where M = ceiling $(D \times k_H / N_{FEC})$, k_H is the number of bits to be loaded onto the OFDM symbol carrying the header, and D is the number of symbols to be used for header transmission
- The encoded header block shall be formed by concatenation of M copies of the header FEC encoder output. As each codeword is cascaded to one another, the bits (b_i) within a codeword shall be cyclically shifted by 2 bits as follows:
  - The 1st FEC codeword copy shall be formed as $\{b_0, b_1, \ldots, b_{NFEC-2}, b_{NFEC-1}\}$.
  - The 2nd FEC codeword copy shall be formed as $\{b_2, b_3, \ldots, b_{NFEC-1}, b_0, b_1\}$.
  - The 3rd FEC codeword copy shall be formed as $\{b_4, b_5, \ldots, b_{NFEC-1}, b_0, b_1, b_2, b_3\}$.
  - …

- The M[th] FEC codeword copy, where $M > 3$, shall be formed as $\{b_{(2\times M-2)}, b_{(2\times M-1)}, \ldots, b_{NFEC-1}, b_0, b_1, \ldots, b_{(2\times M-4)}, b_{(2\times M-3)}\}$.

Valid values of D are either 1 or 2. Details for powerline and phoneline are for further study.

For coax (baseband and RF) the number of PHY-frame header shall be two, *i.e.*, $D = 2$.

NOTE: Since the coding rate used for header encoding is ½, the number of bits in the FEC codeword is always even, and the number of bits in the encoded header block is even.

<<End of Text>>

3. References

[1] G.9960 LC comment resolution draft text R7.doc "ITU-T Recommendation G.9960, Unified high-speed wire-line based home networking transceivers - Foundation", Editor for G.hn, Baltimore Maryland, 18 – 26 May 2009.

[2] 09XC-R12a, "G.hn: Draft text for G.9960 Amendment 1 – version 4.0", Xian, China – 27 – 31 July 2009.

4. Summary

It is proposed to agree on the following new items.

New item 5.0.1.2.1.2.0.1		Open	Should the PHY-frame header include exactly two OFDM symbols for coax (baseband and RF)?	09XC-100
New item 5.0.1.2.1.2.0.2		Open	Should the text changes proposed in Sec 2 of 09XC-100 be adopted into 09XC-R12a?	09XC-100

ITU - Telecommunication Standardization Sector Temporary Document 09XC-119

STUDY GROUP 15 Original: English

Xi'an China – 27 – 31 July 2009

Question: 4/15

SOURCE[1]: Intellon Corporation

TITLE: **G.hn: Extended PHY frame header**

ABSTRACT

This contribution proposes to add an option for supporting extended PHY frame headers that contain 2 x PHY_H information bits in order to allow for expansion of the ACKI field and to allow additional header bits for future enhancements to G.9960.

| Introduction | First Heading | Second Heading | Summary |

1. Introduction

The G.9960 draft in §7.1.2.1 alludes to PHY frame headers that contain more than one symbol (although the reference does not make it clear if this is for PIIY frame header symbol repetition or to support additional PIIY frame header information bits), and support for extended PHY frame headers with additional information bits that are encoded with double the symbols used for the non-extended PHY frame header has been discussed in the G.hn group. However, currently, the current text (G.9960 draft, G.9960 Amendment I, or G.hn draft) does not describe support for more than PHY_H information bits in the PHY frame header.

This contribution proposes to add an option for supporting an extended PHY frame header with 2 x PHY_H information bits in order to allow for expansion of the ACKI field and to allow additional header bits for future enhancements to G.9960. A larger ACKI field allows more frames to be acknowledged, and is especially useful for bi-directional transmissions, which is proposed in separate contribution.

Proposed is to define two one-bit fields which are assigned to bits in the PHY frame header that are currently reserved. The extended header indication (EHI) is set to indicate that the PHY header contains 2 x PHY_H information bits, allowing receivers to determine how to decode the PHY header.

The immediate response frame extended header indication (IREHI) tells receivers if they should respond with a header than contains PHY_H or 2 x PHY_H information bits when transmitting immediate response frames. This allows receivers to know if sufficient time has been allocated for a immediate response frame and for nodes tracking durations to know the duration of a frame transmission sequence. If at some point the definition of the duration field is modified so that it includes immediate response frames (ACK frame), then it may be possible to eliminate the IREHI bit.

This contribution proposes two HCS fields to independently protect the content of each set of PHY_H information bits in the PHY header. Two independent HCS fields results more robust protection of the header contents. It also eliminates ambiguity for receivers when determining how to decode the PHY frame header. If a single HCS field were to be defined that protected 2 x PHY_H information bits then the IREHI bit would need to be interpreted and acted on before the bit is verified with the HCS.

[1]Contacts: Sid Schrum, Intellon Corporation sid.schrum@intellon.com

2. Proposed Text Updates

<<Start Text – G.9960 Amendment I>>

7.1.2.3 PHY-frame header

The PHY-frame header contains ~~is~~ PHY_H information bits if the extended header information (EHI) bit is set to zero and 2 x PHY_H information bits if the EHI bit is set to one. ~~long~~ and is composed of a common part and a variable part. The common part contains fields that are common for all PHY-frame types. The variable part contains fields according to the PHY-frame type. PHY-frame type is indicated by the FT field. The PAD fields fit the length of the header of different PHY frame-types to the standard values of PHY_H bits. The content of the header is protected by the 16-bit header check sequences (HCS, and P_HCS in the case of the extended PHY header).

The fields of the PHY-frame header are defined in Table 7-1

Table 7-1/G.9960 – PHY-frame header fields

Field	Octet	Field Size [Bits]	Description	
FT	0	4	Frame type	Common part
DOD	0	4	Domain ID	
SID	1	8	The device ID of the source node	
DID	2	8	The device ID of the destination node	
MI	3	1	Multicast indication identifies whether the DID is a multicast destination	
PHI	3	1	Post header indication identifies whether the first payload symbol after the header is a PRBS symbol or a data symbol	
EHI	3	1	Extended PHY frame header indication.	
IREHI	3	1	Immediate response frame extended PHY frame header indication.	
Reserved	3	~~4~~6	Reserved by ITU-T	
Duration	4-5	16	The PHY frame transmission duration	
…	6-18			Variable part
HCS	19-20	16	Header check sequence	Common part
	21-39 [1]			Variable part 2 (present for extended PHY frame header only)
P_HCS	40- 41 [1]	16	Extended PHY header - header check sequence	Common part (present for extended PHY frame header only)
Notes [1] These fields are present only if the EHI bit is set.				

7.1.2.3.1.8 Extended header indication (EHI)

The EHI field when set indicates that the PHY frame header contains 2 x PHY_H information bits. If the EHI field is zero then the header of the PHY frame contains PHY_H information bits. The EHI field shall be set to zero for all frames types except the ACK frame. In ACK frames this bit may be set to zero or one.

7.1.2.3.1.9 Immediate response frame extended header indication (IREHI)

The IREHI field when set indicates that receivers shall use for immediate response frames (ACK for example) extended PHY-frame headers. If the IREHI field is zero then immediate response frames shall use standard (non-extended) PHY-frame headers.

7.1.2.3.1.810 Header check sequence and Extended header check sequence (HCS and E_HCS)

The HCS and E_HCS field~~s~~ are~~s~~ intended for PHY-frame header verification. The HCS is a 16-bit cyclic redundancy check (CRC) and shall be computed over all the fields of the first PHY_H information bits of the PHY-frame header in the order they are transmitted, starting with the MSB of the frame type (FT) field and ending with the LSB of the last field in the first PHY_H information bits of the PHY Frame. The E_HCS is present only for extended PHY header frames and shall be computed over all the fields of the second set of PHY_H PHY-frame header information bits in the order they are transmitted, starting with the MSB of the first field in the second set of PHY_H information bits of the PHY-frame header and ending with the LSB of the last field in the second set of PHY_H information bits.

The HCS and E_HCS shall be computed using the following generator polynomial of degree 16:

$G(x) = x^{16} + x^{12} + x^5 + 1$.

The value of the HCS and E_HCS shall be the remainder after the contents (treated as a polynomial where the first input bit is associated with the highest degree, $X^{PHYH-17}$, where PHY_H is the number of header information ~~length in bits~~ bits over which the HCS or E_HCS is computed, and the last input bit is associated with X^0) of the calculation fields is multiplied by x^{16} and then divided by $G(x)$.

The HCS and E_HCS field~~s~~ shall be transmitted starting with the coefficient of the highest order term (MSB).

7.1.2.3.2.2 ACK PHY-frame type specific fields (working text)

Table 7-11.1 lists the ACK PHY frame type specific fields.

Table 7-11.1/G.hn – ACK PHY Frame Type Specific Fields

Field	Size in bits
FACK	3
FLCTRLT	1
FLCTRL	3
LSSNP	1
RXRST_DATA	1
RXRST_MNGMT	1
ACKI/LSSN	16
ACKI	64
~~RXRST_DATA~~	~~1~~
~~RXRST_MNGMT~~	~~1~~
Pad	padding until PHY_H
ACKI [1]	136
Pad [1]	padding until $2 \times PHY_H$
Notes [1] These fields are present for the extended PHY-frame header only.	

<<End Text - G.9960 Amendment I>>

3. Summary:

This contribution is intended to be discussed at the G.hn meeting to be held in Xi'an China – 27 – 31 July 2009.

This contribution proposes changes to working text.

Specifically proposed are the following new agreements:

5.0.1.2.1.0.2.1.5		New	should the PHY frame header number of information bits be optionally expandable to 2 x PHYH bits as described in contribution 09XC-119?	09XC-119
5.0.1.2.1.0.2.1.6		New	should the text proposed in §2 of 09XC-119 that adds fields and description for supporting extended PHY-frame headers be incorporated as a revision of working text for §7.1.2.3 "PHY-frame header" and the sub-clauses for §7.1.2.3 in G.9960 Amendment 1?	09XC-119

ITU-T Recommendation G.9960
Draft generation home Networking transceivers

Table of contents

Summary 4
Keywords 4
Introduction 4
1 Scope 4
2 References 4
3 Definitions 5
4 Abbreviations 9
5 HN architecture and reference models 10
5.1 HN architecture and topology 10
5.1.1 HN Domains 11
5.1.1.1 General rules of operation 11
5.1.1.2 Modes of operation 12
5.1.1.3 Relationship between domain and medium 14
5.1.2 Domain master functionality and node parameters 16
5.1.3 Global master function 17
5.1.4 Quality of service (QoS) 18
5.1.5 Security 19
5.1.6 Inter-domain bridging 20
5.1.6.1 End-to-end QoS for multi-domain connections 22
5.1.6.2 Security in multi-domain connections 22
5.1.7 Low power modes 22
5.2 Reference models 23
5.2.1 Protocol reference model of HN transceiver 23
5.2.2 Interfaces - functional description 25
5.2.2.1 A-interface 25
5.2.2.1.1 AIF_DATA.REQ 25
5.2.2.1.2 AIF_DATA.CNF 26
5.2.2.1.3 AIF_DATA.IND 26
5.2.2.1.4 AIF_CTRL.REQ 26
5.2.2.1.5 AIF_CTRL.CNF 27
5.2.2.1.6 AIF_CTRL.IND 27
5.2.2.2 Medium-Independent Interface (MII) 27
5.2.2.3 Medium-dependent interface (MDI) 28
5.2.3 Functional model of an HN transceiver 28
6 Profiles 29
7 Physical layer specification 30
7.1 Media independent specification 30
7.1.1 Functional model of the PHY 30
7.1.2 Physical coding sub-layer (PCS) 31
7.1.2.1 PHY frame 31
7.1.2.2 MPDU mapping 32

7.1.2.3 PHY-frame header 32
7.1.2.3.1 Common part fields 33
7.1.2.3.1.4 Destination ID (DID) 34
7.1.2.3.1.5 Multicast Indication (MI) 34
7.1.2.3.1.7 Duration 34
7.1.2.3.2 Variable part specific fields 35
7.1.3 Physical medium attachment (PMA) sub-layer 42
7.1.3.1 Scrambling 43
7.1.3.2 FEC encoding 43
7.1.3.2.1 Encoder 45
7.1.3.2.2 FEC encoding parameters 47
7.1.3.3 Payload encoding 47
7.1.3.3.1 Payload repetition encoding 48
7.1.3.4 Header encoder 51
7.1.3.5 Segmentation into symbol frames 51
7.1.3.5.1 Payload segmentation 52
7.1.3.5.2 Header segmentation 52
7.1.3.6 Probe frame 52
7.1.4 Physical medium dependent (PMD) sub-layer 52
7.1.4.1 Sub-carrier spacing and logical indexing 53
7.1.4.2 Tone Mapper 54
7.1.4.2.1 Summary of sub-carrier types 54
7.1.4.2.5 Special mappings 57
7.1.4.2.6 Modulation of unloaded sub-carriers 57
7.1.4.3 Constellation Encoder 58
7.1.4.3.1 Constellation mapping 58
7.1.4.3.2 Constellation point scaling 62
7.1.4.3.3 Constellation Scrambler 63
7.1.4.4 OFDM modulator 64
7.1.4.4.1 IDFT 65
7.1.4.4.2 Cyclic extension and OFDM symbol 65
7.1.4.4.3 Symbol Timing 66
7.1.4.4.4 Windowing, overlap and add 67
7.1.4.4.5 Frequency up-shift 68
7.1.4.4.6 Output signal 68
7.1.4.5 Preamble 69
7.1.4.5.1 General preamble structure 69
7.1.4.5.2 Preamble generation 70
7.1.4.6 PMD control parameters 72
7.1.4.7 Symbol boost 73
7.1.5 Transmit PSD Mask 74
7.1.5.1 Sub-carrier masking (notching) 74
7.1.5.2 PSD ceiling 74
7.1.5.3 PSD shaping 74
7.1.5.4 Notching of International Amateur radio bands 75
7.2 Media dependent specification 75
7.2.1 Physical layer specification over phone lines 75
7.2.1.1 Control parameters 75
7.2.1.2 Preamble 76
7.2.1.2.1 Default preamble structure 76

7.2.1.3 PSD mask specifications 77
7.2.2 Physical layer specification over power lines 79
7.2.2.1 Control parameters 79
7.2.2.2 Preamble 80
7.2.2.2.1 Default preamble structure 80
7.2.2.3 PSD mask specifications 81
7.2.3 Physical layer specification over coax 83
7.2.3.1 Control parameters 83
7.2.3.2 Preamble 84
7.2.3.2.1 Default preamble structure 84
7.2.3.3 PSD mask specifications 85
7.2.3.4 Coexistence on coax 89
7.2.4 Transmitter EVM Requirements 89
Annex A – Regional requirements for North America 90
Annex C – Regional requirements for Japan 91
C.1 Scope 91
C.2 Media dependent specification 91
C.2.1 Physical layer specification over phonelines 91
C.2.2 Physical layer specification over powerlines 91
C.2.2.1 Frequency use for powerlines 91
C.2.3 Physical layer specification over coax 91
C.2.3.1 Bandplan 91
C.2.3.2 Transmitter EVM Requirements for RF coax 92
Annex D – International Amateur radio bands 93
Appendix I: Consideration of Domains Comprising Multiple Wire Classes 94
Appendix II: Examples of HN topologies 96
Appendix III: Spectral usage 101
III.1 Scope 101
III.2 Spectral usage in Japan 101
III.2.1 Frequency allocation for coax 101
III.2.1.1 Terrestrial broadcast signal mapped to coax cable 101
III.2.1.2 Broadcast Satellite (BS) and Communication Satellite (CS) signal mapped to coax cable 102
III.2.1.3 CATV services on coax cable 103
III.2.2 Frequency allocation for phone line 104
III.2.3 Frequency allocation for power line 104
III.2.4 Bibliography 104
Appendix IV - Priority Mapping 106

ITU-T Draft Recommendation G.9960

Next generation wireline based home networking transceivers – Foundation

Summary

This Foundation Recommendation specifies basic characteristics of next generation home networking transceivers capable of operating over premises wiring including inside telephone wiring, coaxial cable, and power line wiring, and combinations of these, at data rates up to 1 gigabit/second. The specification includes a description of the home network architecture and reference models along with major aspects of the transceiver physical layer specification. A future version of this Recommendation will include the data link layer and regional Annexes to complete the transceiver specification.

Keywords

<Optional>

Introduction

This Foundation Recommendation specifies basic characteristics of home networking transceivers capable of operating over premises wiring including inside telephone wiring, coaxial cable, and power line wiring, and combinations of these. The transceivers defined by this specification provide the data rate and quality of service necessary for triple-play residential services as well as business-type services delivered over xDSL, PON, or other access technology. The transceivers use OFDM type of modulation and are designed to provide EMC and spectral compatibility of home networking transmission with VDSL2 and other types of DSL used to access the home.

1 Scope

This Foundation Recommendation specifies basic characteristics of home networking transceivers designed for the transmission of data over in-premises networks operating over phoneline, powerline or coax.

Specifically, this Recommendation defines:

- the home network architecture and reference models;
- major aspects of the physical layer specification (PCS, PMA and PMD), including PSD limit masks;

These devices are intended to be compatible with other devices sharing the in-premises wiring.

Additionally, the Recommendation provides for spectrum notching for compatibility with Amateur radio services.

A future version of this Recommendation will specify the data link layer, including APC, LLC and MAC.

2 References

The following ITU-T Recommendations and other references contain provisions, which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the

most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[1] ITU-T Recommendation X.1035 (2007), *Password-authenticated key exchange (PAK) protocol*

3 Definitions

This Recommendation defines the following terms:

Alien domain: any group of non-HN nodes connected to the same medium or operating in a close proximity. Alien domains can interfere with HN domains. The bridging function to an alien domain, as well as coordination with an alien domain to avoid mutual interference is beyond the scope of G.9960.

> NOTE – HN nodes see interference from an alien domain as a generic external noise and deals with it accordingly. An example of an alien domain could be the in-home part of the access network or any non-HN home network operating over the same wires or other type of media.

Bridge to alien domain/network: an application device implementing an L2 or L3 bridging function to interconnect an HN node to a node of an alien domain (or alien network). Bridging to alien domains/networks is beyond the scope of G.9960.

Broadcast: a type of communication where a node sends the same packet simultaneously to all other nodes in the network or in the domain (domain broadcast).

Centralized (CTR): a type of communication within a domain in which an HN node can communicate with other HN nodes through a relay node. The relay node receives a signal from the HN node and further forwards it to the addressee nodes.

Channel: a transmission path between G.9960 nodes. One channel is considered to be one transmission path. Logically a channel is an instance of communications medium used for the purpose of passing data between two or more nodes.

Client: an application entity distinguished in the network by its unique address (e.g., MAC address).

Client association Table (CAT): a table that associates a Client address with a G.9960 node through which this client can be reached from within the domain.

Coding overhead: a part of the overhead used to carry the coding redundancy (such as redundancy bits of error correction coding or CRC).

Crosstalk: disturbance (including packet collision) introduced by or due to operation of alien networks or other (independent) G.9960 networks.

Data: bits or bytes transported over the medium or via a reference point that individually convey information. Data includes both user (application) data and any other auxiliary information (overhead, including control, management, etc.). Data does not include bits or bytes that, by themselves, do not convey any information, such as frame alignment bits or preamble.

Data packet (packet): an ordered group of bits or bytes with start and stop delimiters.

Data rate: the average number of data elements (bits, bytes, packets or frames) communicated (transmitted) in a unit of time. Depending on the data element, data bit rate, data byte rate, data packet rate, and symbol frame rate may be used. The usual unit of time for data rate is 1 second.

Device ID: a unique identifier allocated to a G.9960 node operating in the network by the domain master after registration.

Domain: a part of a home network comprising all those G.9960 nodes that can communicate, interfere, or both with each other directly at the physical layer. There is no interference between different domains of the same home network (except crosstalk between closely routed wires).

Domain access point: The unique relay node in centralized mode (CM) through which all nodes communicate.

Domain ID: a unique identifier of a G.9960 domain.

Domain master (DM): node of a domain managing (coordinating) all other nodes of the same domain (i.e., assign bandwidth resources and manage priorities). Only one active domain master is allowed in a domain, and all nodes within a domain are managed (coordinated) by a single domain master. If a domain master fails, another node of the same domain, capable of operating as a domain master, should pick up the function of the domain master.

Flow: a uni-directional stream of data between two G.9960 nodes related to a specific application and/or characterized by a specific set of performance and traffic parameters (e.g. QoS parameters, latency, jitter, PLR).

Flow ID: a unique identifier allocated to a flow within a domain.

Global master (GM): a function that provides coordination between different HN domains (such as communication resources, priority setting, policies of domain masters, and crosstalk mitigation). A GM may also convey management functions initiated by the remote management system (e.g. TR-69) to support broadband access. The GM is an optional function.

Guard interval: the time interval intended to mitigate corruption of data carried by the symbol due to ISI from the preceding symbols. In OFDM, the guard interval is implemented as a cyclic extension (cyclic prefix and/or cyclic suffix).

Hidden node: a node that can't communicate directly with some other nodes within a domain.

NOTE – A hidden node may be able to communicate with another node or with a domain master using a relay node. A node that is hidden from a domain master uses a relay node as a proxy to communicate with the domain master.

Inter-domain bridge: a bridging function above the physical layer to interconnect HN nodes of two different HN domains.

Jitter: a measure of the latency variation above and below of the mean latency value. The maximum jitter is defined as the maximum latency variation above and below the mean latency value.

Latency: a measure of the delay from the instant when the last bit of a packet has been transmitted through the assigned reference point of the transmitter protocol stack to the instant when a whole packet reaches the assigned reference point of receiver protocol stack. Mean and maximum latency estimations are assumed to be calculated on the 99th percentile of all latency measurements. If retransmission is set for a specific flow, retransmission time is a part of latency for the protocol reference points above MAC.

Line data rate: the data rate at the MDI reference point of the transceiver reference model. This is the net data rate plus the overhead rate.

Logical (functional) interface: an interface in which the semantic, syntactic, and symbolic attributes of information flows are defined. Logical interfaces do not define the physical properties of signals used to represent the information. It is defined by a set of primitives.

Management overhead: a part of the overhead used for management purposes (such as network discovery, channel estimation, acknowledge, establishing and tearing the flow).

Medium: a wire-line facility, of a single wire class, allowing physical connection between network nodes (see Appendix I for medium composed of multiple wire classes). Nodes connected to the same medium may communicate on the physical layer, and may interfere with each other unless they use orthogonal signals (e.g., different frequency bands).

Multicast: a type of communication when a node sends the same packet simultaneously to one or more other nodes in the network (the addresses could be both inside and outside the domain).

Net data rate: the data rate available at the A-interface of the transceiver reference model.

Node (network node): any home network device that contains a transceiver. An HN node is any network device that contains a G.9960 transceiver.

Operation modes of a domain:

- **peer-to-peer mode (PM):** a mode of domain operation in which all HN nodes use only PP type of communication with other nodes (without relay nodes). In peer-to-peer mode, no relay nodes are allowed.

- **centralized mode (CM):** a mode of domain operation in which all HN nodes use **CTR** type of communication with a single relay node. In centralized mode, only one relay node is allowed and it is known as the domain access point (DAP).

NOTE – A DAP is likely to serve also as a Domain Master

- **unified mode (UM):** a mode of domain operation in which all nodes within a domain communicate using PP or CTR type of communication, as necessary, while some of the relay nodes may have additional functionalities. Unified mode can be used to support hidden nodes. In unified mode, more than one relay node is allowed.

NOTE – In UM, there is no domain access point defined.

Overhead rate: a part of the line data rate used to support network operation. It includes transmission overhead, management overhead, and coding overhead.

Packet error ratio (PER): a ratio of the number of errored packets received to the total number of received packets. The PER can be used for the total stream of packets (aggregated PER) and for any of its tributary packet flows (PER per flow).

Packet loss ratio (PLR): a ratio of the number of lost packets to the total number of received packets. The PLR can be used for the total stream of packets (aggregated PLR) and for any of its tributary packet flows (PLR per flow).

Passband: the portion of the frequency spectrum that is allowed to be used for transmission. The passband may consist of multiple, disjoint portions of the frequency spectrum.

Peer-to-peer (PP): a type of communication within a domain in which direct signal traffic is established between HN nodes with no relay nodes.

Physical interface: an interface defined in terms of physical properties of the signals used to represent the information transfer. A physical interface is defined by signal parameters like power (power spectrum density), timing, and connector type.

Primitives: basic measures of quantities obtained locally or reported by other nodes of the domain. Performance primitives are basic measurements of performance-related quantities, categorized as events, anomalies and defects. Primitives may also be basic measures of other quantities (e.g., ac or battery power).

Priority: a value assigned to the specific packet(s) that determines the relative importance of transmitting packet(s) during the upcoming opportunity to use the medium.

Quality of service (QoS): a set of quality requirements on the communications in the network. Support of QoS refers to mechanisms that can provide different priority to different flows, or can guarantee a measurable level of performance to a flow based on a set of QoS parameters.

Reference point: a location in a signal flow, either logical or physical, that provides a common point for observation and or measurement of the signal flow.

Registration: the process used by a G.9960 node to join the domain.

Relay node: an HN node acting as an intermediary node, through which other nodes of the same domain can pass their signal traffic (data, control, or management) in either direction of transmission.

Residential Gateway: a device providing, among other functions, bridging between the access network and the home network. Residential gateways are out of scope of G.9960.

Stopband: the portion of the frequency spectrum that is not allowed for transmission.

Sub-carrier (OFDM sub-carrier): the center frequency of each OFDM sub-channel onto which bits may be modulated for transmission over the sub-channel.

Sub-carrier spacing: the difference between frequencies of any two adjacent OFDM sub-carriers.

Sub-channel (OFDM sub-channel): a fundamental element of OFDM modulation technology. The OFDM modulator partitions the channel bandwidth into a set of parallel sub-channels.

Symbol (OFDM symbol): a fixed time-unit of an OFDM signal carrying one or more bits of data. An OFDM symbol consists of multiple sine-wave signals or sub-carriers, each modulated by certain number of data bits and transmitted during the fixed time called symbol period.

Symbol frame: A frame composed of bits of a single OFDM symbol period. Symbol frames are exchanged over the δ-reference point between the PMA and PMD sub-layers of the PHY.

Symbol rate: the rate, in symbols per second, at which OFDM symbols are transmitted by a node onto a medium. Symbol rate is calculated only for time periods of continuous transmission.

Throughput (node): The amount of data transferred from the A-interface of a source node to the A-interface of a destination node over some time interval, expressed as the number of bits per second.

Transmission overhead: a part of the overhead used to support transmission over the line (e.g., samples of cyclic prefix, inter-packet gaps, and silent periods).

Unicast: a type of communication when a node sends the packet to another single node (inside or outside of the domain).

Wire class: one of the classes of wire, having the same general characteristics: coaxial cable, home electrical power wire, phone line wire and Category 5 cable.

4 Abbreviations

This Recommendation uses the following abbreviations:

AE	application entity
AN	access network
APC	application protocol convergence
CM	centralized mode of domain operation
CoS	class of service
CTR	centralized type of communication
DAP	domain access point
DLL	data link layer
DM	domain master
DSL	digital subscriber line
GM	global master
HN	home network comprising exclusively G.9960 network devices
LDPC-BC	low-density parity-check block-codes
LLC	logical link control
MAC	media access control
MAP	media access plan
MDI	medium-dependent interface
MII	media-independent interface
OFDM	orthogonal frequency division multiplexing
PCS	physical coding sub-layer
PM	peer-to-peer mode of domain operation
PMA	physical medium attachment
PMD	physical medium dependent
PON	passive optical network
PP	peer-to-peer type of communication
QC-LDPC-BC	Quasi-cyclic low-density parity-check block-code
QoS	quality of service
RG	residential gateway
UM	unified mode of domain operation

5 HN architecture and reference models

5.1 HN architecture and topology

A generic structure of HN is presented in Figure 5-1. The model includes one or more domains, inter-domain bridges, and bridges to alien domains of a home network (e.g., WiFi, ethernet, USB), and a bridge to the access network (e.g., DSL, PON, cable). The global master is an optional function that provides coordination between different HN domains (such as channel resources, priority setting, domain operational characteristics), and may convey the relevant functions initiated by the remote management system (e.g., Broadband Forum TR-069) to support broadband access. Bridges to alien domains are beyond the scope of G.9960.

NOTE 1 – It is not necessary that all inter-domain bridges presented in Figure 5-1 be used. Depending on the application, domains could be daisy-chained, or star-connected, or could use another connection topology. Multi-route connections between domains are not allowed.

NOTE 2 – Implementations of some nodes, e.g., residential gateway (RG), can include inter-domain bridges allowing connection of the RG to more than one domain (more than one medium).

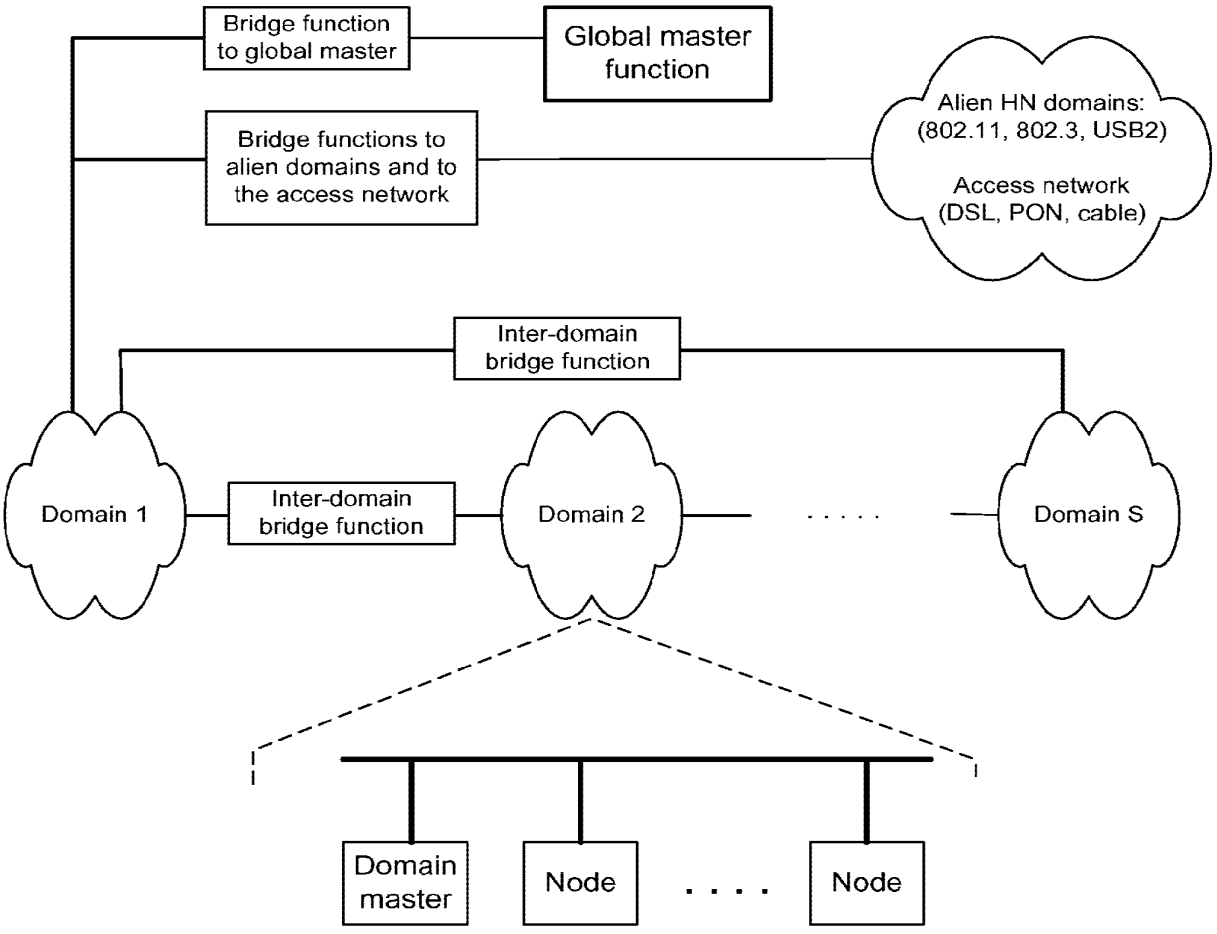


Figure 5-1/G.9960 – G.9960 architecture reference model

A domain contains HN nodes connected to the same medium, where one node is acting as a domain master. Nodes of the same domain communicate via the medium over which the domain is established. Nodes connected to different domains communicate via inter-domain bridges (e.g. L2 or L3 bridging, see §5.1.6).

A domain shall be capable of supporting at least 32 registered nodes and may optionally support up to 250 registered nodes. Each node shall be capable of supporting simultaneous communication sessions with at least 8 other nodes using dedicated transmission profiles (runtime BATs), different from the pre-defined transmission profiles described in §7.1.4.2.2.1.

The scope of G.9960 is limited to transceivers of all HN nodes capable of operating as a regular node or a domain master, or as a domain access point (DAP) or as a relay node of any HN domain. Other parts of HN, including inter-domain bridges, RG (as a bridge to the access network), and bridges to alien domains, are beyond the scope of G.9960; however G.9960 defines all necessary hooks to support their functionality and exchange of relevant information.

The domain master considers bridges to alien domains as regular clients of an HN node with certain bandwidth requirements, while it considers inter-domain bridges as regular clients whose interfaces (see §5.1.6) comply with requirements implied by this Recommendation.

5.1.1 HN Domains

5.1.1.1 General rules of operation

A domain as depicted in Figure 5-1 may include the following types of nodes: regular nodes, relay nodes, a domain master, and a DAP.

The function of the domain master is to assign and coordinate resources (bandwidth and priorities) of all nodes in its domain. The following rules apply for any domain:

1. There shall be one and only one active domain master per domain. In case an active domain master is not assigned, fails, or is switched off, a domain master selection procedure is initiated to assign a new active domain master. This procedure is for further study.
2. Nodes of the same HN network that can communicate and interfere with each other directly at the physical layer (except crosstalk between closely routed wires) shall be assigned to the same domain.
3. All HN nodes within a domain shall be capable of operating in PP type of communication and CTR type of communication (the CTR is considered as a subset of PP, where the first destination address for the node is a relay node). For both PP and CTR types of communication, bandwidth resources and priorities of all nodes within the domain are managed by the domain master.
4. More than one domain may be established over the same medium, for example, by using orthogonal signals over different frequency bands.
5. A G.9960 network may include one or more domains.
6. Domains from independent G.9960 networks established over the same medium may interfere with each other (e.g., if they use the same frequency band). Coordination between G.9960 domains of independent networks sharing a common medium is for further study.
7. G.9960 nodes are not required to be domain master capable. That is, some G.9960 nodes may not support the functionality necessary to become a domain master.
8. All nodes in a domain shall be managed by a single domain master.

9. The HN network shall have a unique network name. All domains of the same HN network shall use this network name.
10. The domain master shall assign a device ID to a node during the node's registration process.
11. All nodes within the same domain shall use the same domain ID.
12. A node shall not pass via its A-interface packets contained in PHY frames sourced by other domains (having a different domain ID value than the one that the node is associated with). A node shall be capable of detecting existence of a neighbouring domain when receiving its PHY frame (having a different domain ID value than the one that the node is associated with).

NOTE – The method of determining a domain ID for assignment is for further study.

5.1.1.2 Modes of operation

A domain can operate in one of 3 modes: peer-to-peer mode (PM), centralized mode (CM), and unified mode (UM). Different domains within the HN can use different modes of operation, i.e. PM, CM, or UM. Examples of domains in different operation modes are presented in Appendix II.

Broadcast and multicast shall be supported in any domain, independently of its operation mode (PM, CM or UM).

In PM, only PP type of communication shall be used in the domain. Thus, direct signal traffic is established between two communicating nodes. Figure 5-2 shows PP communication between nodes A and B. Packets addressed to nodes outside the domain are sent to the node associated with the inter-domain bridge (node C in Figure 5-2).

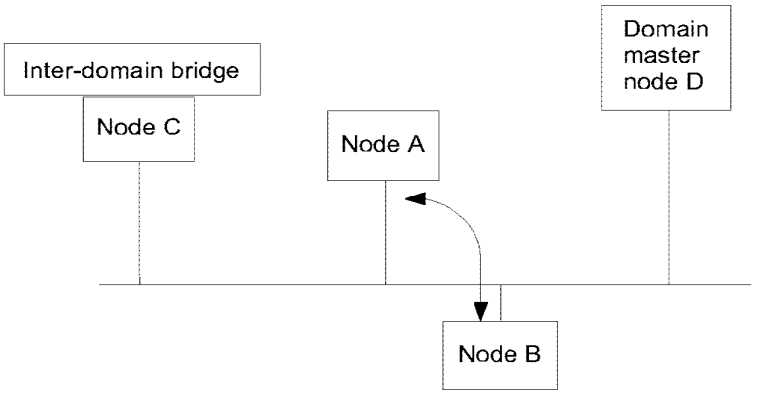


Figure 5-2/G.9960 – Domain operating in peer-to-peer mode (PM)

In CM, only CTR type of communication shall be used. Thus, any node of the domain can communicate with another node only through the DAP. The DAP receives signals from all nodes of the domain and further forwards them to the corresponding addressee nodes. Packets addressed to

nodes outside the domain are forwarded by the DAP to the node associated with the inter-domain bridge (node C in Figure 5-3). Usually, but not necessarily, the DAP also serves as a domain master (Figure 5-3).

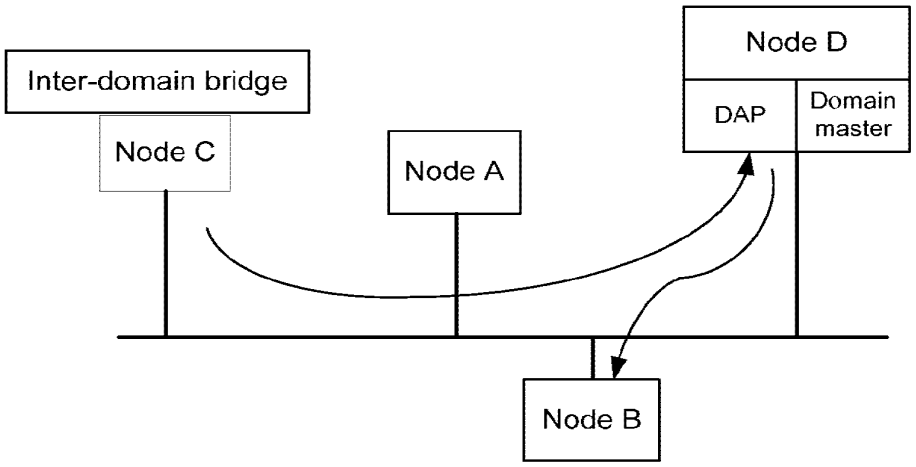


Figure 5-3/G.9960 – Domain operating in centralized mode (CM)

In case of DAP failure, no communication between nodes in the domain is allowed.

In UM, a hidden node in a domain can communicate with another node through a relay node as shown in Figure 5-4. In the example, two nodes within the same domain (Node C and Node H) that are hidden from each other communicate with each other via the relay node (Node A). Both nodes are managed by the domain master (Node D) and can communicate directly with all other nodes. Packets addressed to nodes outside the domain are sent to the node associated with the inter-domain bridge (node C in Figure 5-4).

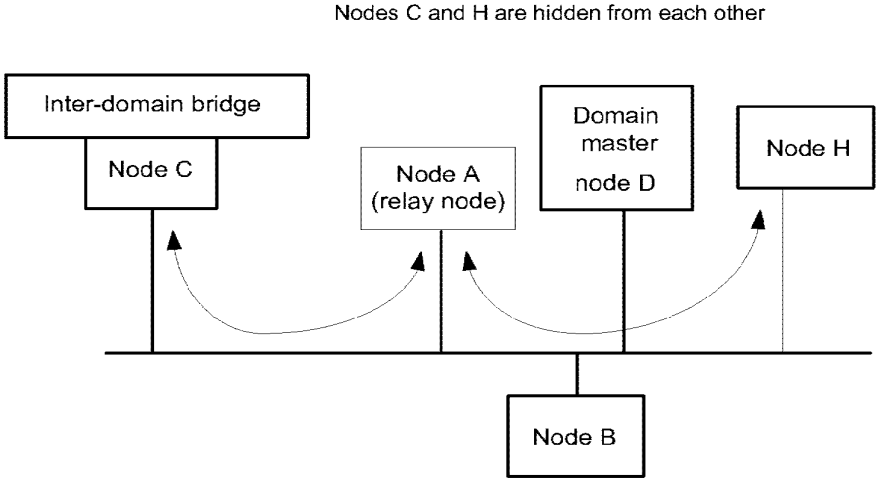


Figure 5-4/G.9960 – A domain operating in Unified mode (UM) containing hidden nodes

5.1.1.3 Relationship between domain and medium

Figure 5-5 shows several examples of the relationships between domain, medium and wire class. Note that in Figure 5-5, each of the domains is shown to be associated with a single medium. This represents the focus of the HN network; domains optimized to operate on a single wire class with multiple domains interconnected via inter-domain bridges. Figure 5-5 (A) shows an example network segment comprising three different media: coax, phone line and power line. A single domain exists on each medium and the domains are separated by inter-domain bridges. Figure 5-5 (B) shows another example network segment comprising phone line and power line mediums. In this case, the phone line medium comprises two segments of phone wire that are joined by splicing or at a connector. These two phone line segments are of a single wire class and therefore are a single medium. As shown in Figure 5-5 (A), there is a single domain on each medium and the domains are separated by inter-domain bridges. Figure 5-5 (C) shows the example network segment from Figure 5-5 (A), but also demonstrates the potential for having multiple domains on a medium. In Figure 5-5 (C), the phone line medium carries three domains and the power line medium carries two domains. The multiple domains on each individual medium must have orthogonal signaling to avoid interference. For example, on the power line, domain C5 must have signaling that is orthogonal to signaling on domain C6. These domains communicate via inter-domain bridges that are not shown in the figure. Refer to Figure II-3 for an alternative representation of multiple domains on a single medium.

It is possible to interconnect wire classes and operate them under a single domain. This special application of HN is described in Appendix I. However, it is expected that such scenarios would occur very infrequently and such practices will be avoided if possible.

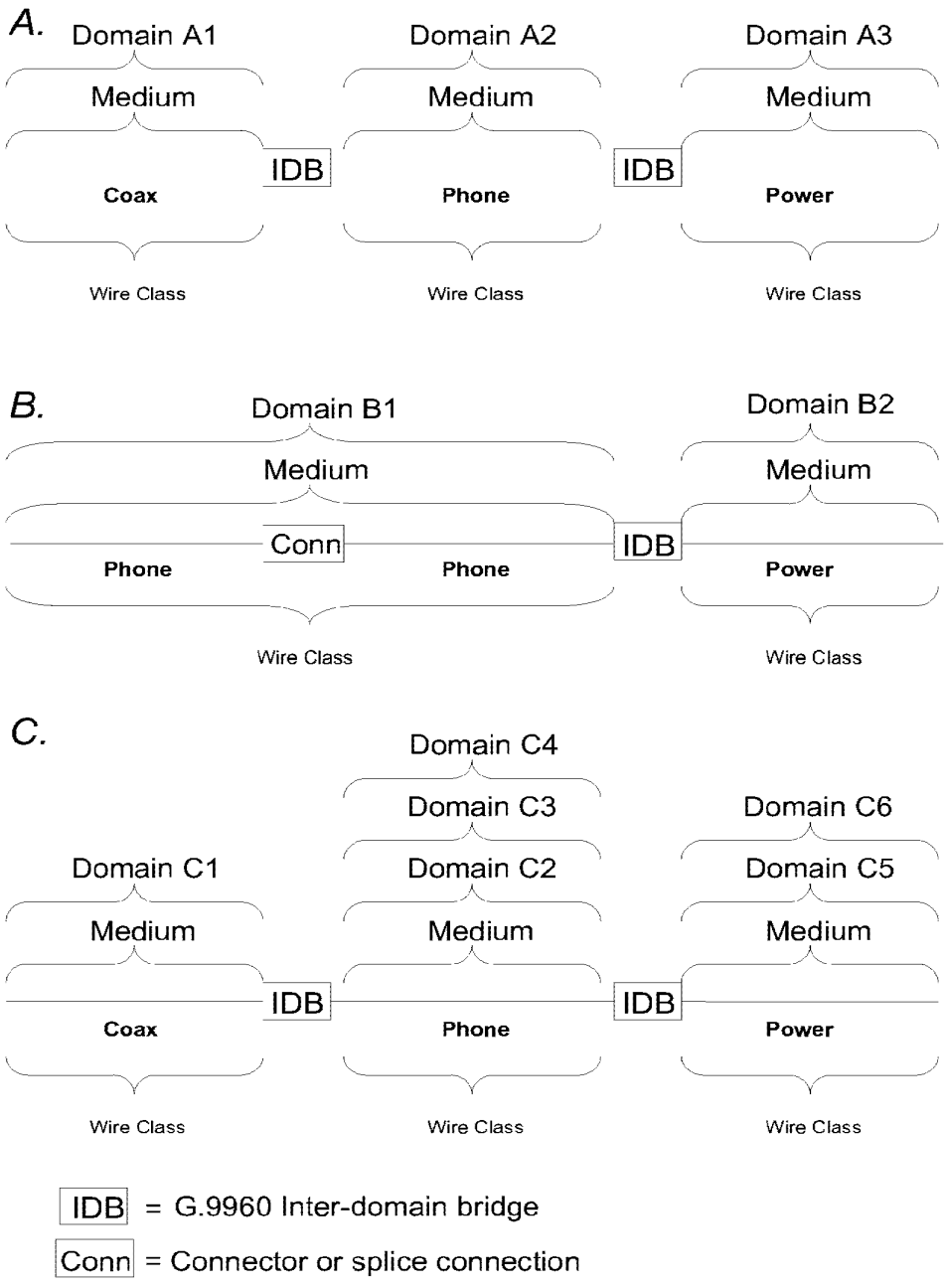


Figure 5-5/G.9960 – Relationships between domain, medium and wire class

5.1.2 Domain master functionality and node parameters

A domain master controls operation of the nodes in the domain. The main functions of a domain master are summarized in Table 5-1.

Table 5-1/G.9960 – Main Functions of the Domain Master

Function	Description	
Indication of presence	Periodically communicates MAP to all nodes in the domain	
Admission control	Admits new nodes to the domain Limits the number of nodes in a domain Facilitates departure of nodes from the domain	
Determination of domain operation	Assigns mode of operation inside the domain (PM, CM, or UM) Supports hidden nodes by assigning MAP repeaters Supports synchronization of the MAC cycle to an external source (e.g., the AC line) Facilitates spectrum compatibility for the domain by assigning relevant limits on: - Frequency band - Maximum transmit power - PSD mask	
Bandwidth allocation and QoS support	Assigns media access rules to all nodes of the domain to facilitates support of QoS	
Security	Assists authentication and encryption keys management	
Monitor status of the domain	Collects statistics of domain operation: - List of nodes in the domain - Topology - Performance statistics (data rate, error count) - Statistics on neighboring domains	
Communication with the global master	Coordinates operation of the domain with other domains using the global master function	
Backup master assignment	Assigning of a backup domain master to take over the domain master role	

The main functions and capabilities of a regular node (end-node) are summarized in Table 5-2.

512 **Table 5-2/G.9960 – Main Functions and capabilities of a regular node**

Function	Description and Parameters	
Interpretation of the traffic specification	Receives and interprets the MAP	
Support of admission control protocol	Supports admission control protocol	
Support of operation modes of the domain	Supports the operation mode (PM, CM, or UM) Complies with spectrum compatibility settings for the domain by assigning relevant limits on: - Frequency band - Maximum transmit power - PSD mask	
Support of media access rules	Accesses media using media access rules coordinated with the domain master	
Support of security	Supports authentication and encryption key management procedures	
Collection and reporting of node information	Provides statistics about: - List of visible nodes - List of clients (CAT) - List of capabilities supported by the node - Performance statistics (data rate, error count, time stamps) - Statistics on detected neighboring networks	
Request of bandwidth allocation	- Creates flows - Requests bandwidth allocations from the domain master in order to meet QoS requirements of flows	
Support of retransmissions	Provides acknowledgment and retransmission of data units that were received with error	
Support of extended capabilities	- Domain Master - Domain Access Point (DAP) - Data Relaying - MAP Repeating - Domain master selection procedure	

513 **5.1.3 Global master function**

514 The global master (GM) function, if implemented, interacts with G.9960 domains and coordinates
515 their operation by exchanging relevant information with domain masters via the logical M-interface
516 as shown in Figure 5-6.

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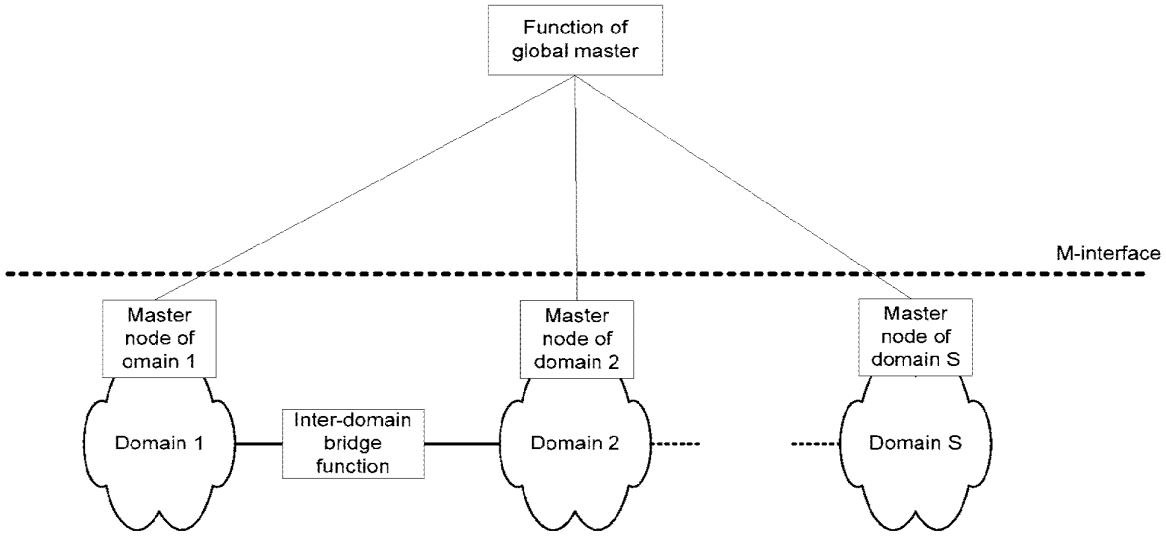


Figure 5-6/G.9960 – Functional model of GM

The following rules apply to the GM:

1. In a multi-domain network, the GM may coordinate some or all domains. For coordination, the GM exchanges information with domain masters of all coordinated domains via the M-interface. The GM may retrieve relevant domain-related data from domain masters and send control signals and data for coordination between domains to domain masters.
2. The M-interface is functional; its physical implementation is vendor discretionary. In case a domain master is replaced (e.g., as a result of a failure), the GM shall interface to the newly selected domain master.
3. The Information exchange protocol between the GM and a domain master is unified for all domains. To identify a specific domain for communication, the GM shall use the domain ID.

NOTE – The GM doesn't limit the number of domains in the network, although the format of the domain ID shall fit the 4-bit field (DOD field in the PHY-frame header – §7.1.2.3), which limits the potential management capability of the GM.

5.1.4 Quality of service (QoS)

Quality of service (QoS) is a measure of the quality of delivery of services in the network, placing requirements on the transmission and queuing of network traffic. G.9960 supports two QoS methods: Priority-based QoS and Parameter-based QoS.

The QoS requirements are supported between nodes inside the same domain and between nodes connected to different domains if services communicated between nodes belong to different domains. In the latter case, inter-domain bridges are expected to not compromise the QoS requirements (such as latency).

For communication inside a domain, the G.9960 QoS mechanism operates per flow. Flows are set up and torn down on a service basis. The type of service communicated by the flow determines the QoS method over the flow and any relevant QoS parameters. Data packets belonging to a specific flow are scheduled to be sent onto the media in accordance with the defined QoS method. The G.9960 QoS method shall handle both constant and variable bit-rate traffic.

Priority-based QoS refers to a mechanism that provides different priorities for media access to different flows. All HN transceivers shall support priority-based QoS. The number of supported priority levels associated with the incoming packets (at A-interface) shall be 8 (denoted from 0 to 7).

With priority-based QoS, the G.9960 transceiver associates each flow with a certain priority queue, based on priority or other priority-related parameters of incoming packets. The G.9960 priority-based QoS method defines the order in which packets from each queue will be sent to the medium and in which order packets will be processed (and possibly dropped), based solely on the priority assigned to the queue. The number of supported priority queues may be less than 8 and depends on the profile. The mapping between the priority of the flow and the associated priority queue shall be as recommended by IEEE 802.1D-2004 for user priority to traffic class mappings, as shown in Appendix IV.

Parameter-based QoS refers to a mechanism that provides specific performance metrics (QoS parameters) for a given flow associated with the application (service), and resource allocation for media access to meet these performance metrics. A set of these parameters may include, but is not limited to, data throughput, latency, jitter, or PER.

With Parameter-based QoS, the G.9960 transceiver associates each flow with a set of QoS parameters related to the particular service and with a certain queue. The G.9960 parameter-based QoS method provides appropriate resources (e.g., bandwidth) necessary to communicate each flow through the medium so that QoS parameters associated with this flow are met. It also determines the order in which packets from each queue will be sent to the medium and in which order packets will be processed (and possibly dropped) based on the knowledge of traffic parameters. The minimum number of supported flows (queues) depends on the profile.

5.1.5 Security

G.9960 security is designed to address operation over shared media, such as power-line and coax cable. Besides regular network admission procedures, which ensure that only permitted G.9960 nodes are allowed to join a G.9960 network via one of its domains, G.9960 defines point-to-point security, allowing authentication of each pair of nodes prior to communication and unique encryption keys for each pair of communicating nodes or per multicast group. This generally improves security by building another layer of protection against an intruder that has broken through the network admission control, and maintains full confidentiality for all communications within the network. The latter suits G.9960 to be installed in public places (hotels, small businesses, home offices), requiring at least the same grade of security and confidentiality as defined in the most recent specification for wireless LAN (IEEE 802.11-2007).

G.9960 security provides the following main features:

- Encryption of all relevant data frames based on AES-128 and NIST recommendations
- Advanced authentication and secure admission of nodes into network domains, based on ITU-T Recommendation X.1035 [1].
- Key management, including generation, secure communication, update, and termination of encryption keys.
- High confidentiality and integrity of all transactions, including point-to-point authentication and unique encryption keys.
- Support of secure operation with the presence of relay (proxy) nodes
- Allows simultaneous operation of distinct, separately secured networks on the same media.

Security procedures that are user-friendly may require the user to set a password for each node prior to installation. The rest of the procedures necessary to establish and maintain security are facilitated automatically by the security controller (SC) function, without involvement of the user.

Nodes that don't include an appropriate user interface may use a unique manufacturer-set password.

For applications in which reduced security is acceptable, the user may rely on a default password provided by the manufacturer. Thus, no action from the user is required on installation, although with a risk to connect the node to neighbouring G.9960 network.

Security and mutual confidentiality between clients associated with the same node is supposed to be resolved at the higher layers of the client protocol stack and is beyond the scope of this Recommendation.

5.1.6 Inter-domain bridging

The inter-domain bridge (IDB) function connects nodes of two G.9960 domains. In Figure 5-7, application entities AE1 (service originator) and AE2 (service destination) are associated with nodes A1 and B2 of two domains. The communication path between nodes A1 and B2 goes through domain 1 and domain 2, and includes in-domain flows F1, F2 and the IDB function. Interfaces between nodes B1, A2 and the IDB are regular client interfaces (A-interfaces, see §5.2.1). Communication paths routed through more than two domains operate in the same way.

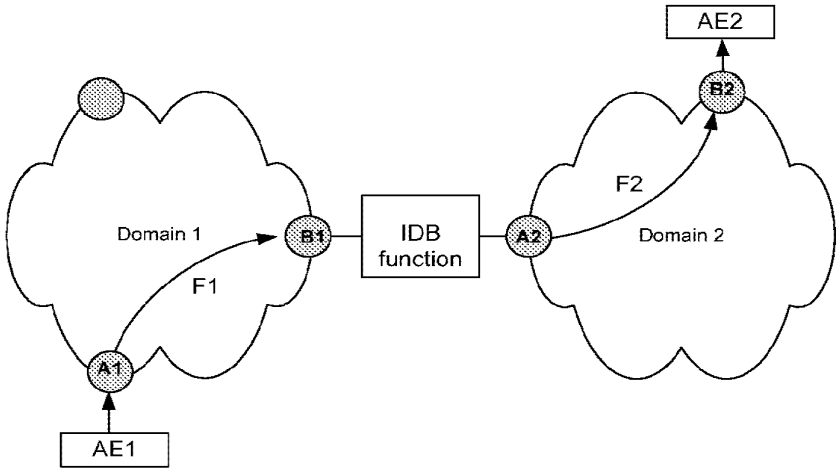


Figure 5-7/G.9960 – Communication path between nodes of two different domains

The protocol reference model for inter-domain communications shown in Figure 5-7 is presented in Figure 5-8.

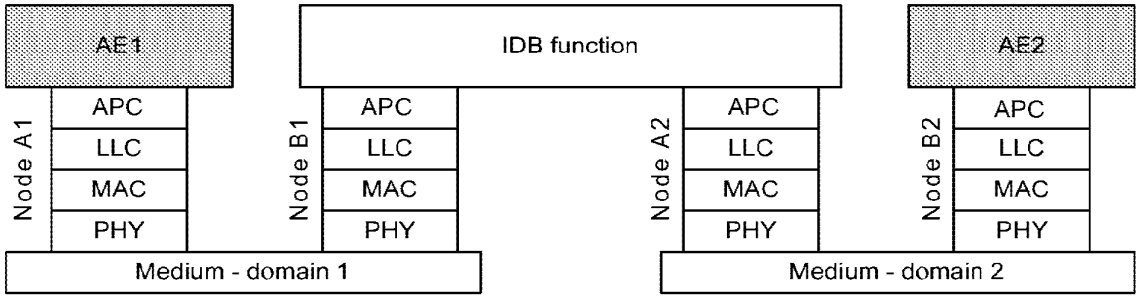


Figure 5-8/G.9960 – Protocol stack of inter-domain communication

In the case that the APC is implemented as an ethernet convergence sub-layer, the IDB function can be implemented as a standard 802.1D transparent bridge.

One case of inter-domain bridging relates to implementation of multi-media devices, which are equipped with more than one physical interface and, accordingly, can be connected to more than one domain. A scenario describing a two-media device is presented in Figure 5-9. The IDB connects the client associated with the device to both domains (via nodes B1 and A2), and provides inter-domain connection (between nodes B1, A2, similar to one presented in Figure 5-7). The IDB interfaces to nodes B1 and A2 as a regular AE, and also bridges the client AE to either or both of these nodes.

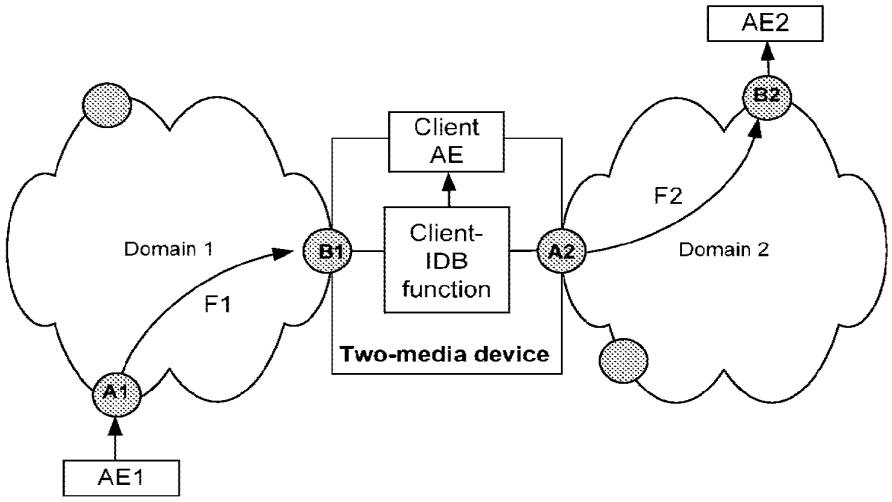


Figure 5-9/G.9960 – Example of communication with a two-media (domain) device

The protocol reference model corresponding to Figure 5-9 is presented in Figure 5-10. It assumes a vendor-proprietary interface between the IDB and the client. However, a standard interface like IEEE 802.3 can be used too.

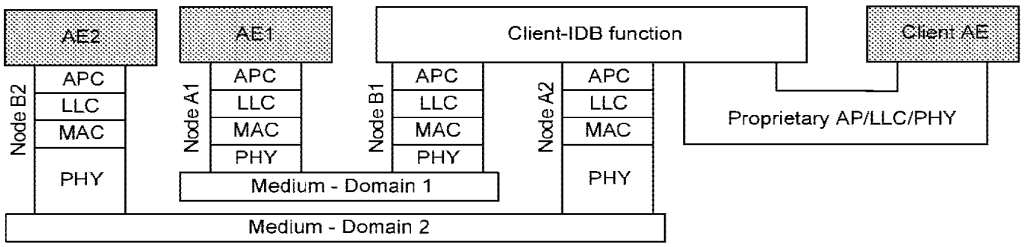


Figure 5-10/G.9960 – Protocol stack of inter-domain communication

5.1.6.1 End-to-end QoS for multi-domain connections

The end-to-end QoS requirements are defined by certain priority level (in case of priority-based QoS), or by traffic parameters such as bit rate and latency (for parameterized QoS). See §5.1.4. In both cases, to meet end-to-end requirements, certain tributary requirements shall be implied on in-domain flows forming the connection and on IDB. In Figure 5-7, the end-to-end QoS requirements for the service routed between nodes A1 and B2 determine tributary QoS requirements for flow F1, carrying the service inside domain 1, and for flow F2, carrying the service inside domain 2, and for the delay introduced by IDB.

In the case of prioritized QoS, the end-to-end QoS requirements can be met if the IDB conveys priority requirements, so that the priority level applied to flow F1 in domain 1 corresponds with the priority level applied to flow F2 in domain 2. In the same way, prioritized QoS shall be supported for routes including more than 2 domains.

In case of parameterized QoS, the end-to-end QoS parameters shall be distributed between in-domain flows and the IDBs. The rules of distribution of end-to-end QoS parameters between multiple domains are for further study.

The IDB throughput shall be higher than the maximum throughput available in either of the domains connected by the IDB. The delay introduced by the IDB should be minimized (the maximum allowed values are for further study). The maximum number of IDBs in the path may be limited for certain service types.

Other parameters of the IDB functionality are vendor discretionary.

5.1.6.2 Security in multi-domain connections

For a multi-domain G.9960 network, secure operation is achieved by setting all its domains to secure mode. Communications between secure and non-secure domains shall not be allowed, unless special security measures are provided by the IDB (on higher protocol levels). These measures are beyond the scope of this Recommendation, same as security measures protecting IDB from outside intrusion (i.e., when the intruder is one of the clients connected to the IDB). In the scope of this Recommendation, IDB are supposed to be secure.

5.1.7 Low power modes

Three modes of operations are defined with the intention of reducing the total power consumption in G.9960 based networks. When the electrical power for equipment connected to the home network is switched on, operation modes for the equipment shall be one of the following:

- Full-power mode: This is the mode in which transmission up to maximum defined bit-rate is possible. In this mode the power consumption is limited only by the defined PSDs.
- Low power mode(s): In these modes only a limited data transmission is running. The equipment enters this mode when specific traffic parameters are met. The values of these parameters are for further study.
- Idle mode: In this mode the equipment is switched on and connected physically to the network, but no traffic at all is transmitted or received by the connected equipment. It should be possible to initiate transmission both from the connected equipment and from other node (or client) connected to the network. Transition from this power mode to full-power mode, when needed, should take no more than 1 second.

During all power modes and transitions between them, the node shall maintain its original DEVICE_ID.

5.2 Reference models

5.2.1 Protocol reference model of HN transceiver

The protocol reference model of an HN transceiver is presented in Figure 5-11. It includes three main reference points: application interface (A-interface), media-independent interface (MII), and medium-dependent interface (MDI). Two interim reference points, x1-interface and x2-interface, are defined in the data link layer, and two other interim reference points, α-interface and δ-interface, are defined in PHY layer, Figure 5-11.

The MDI is a physical interface defined in the terms of physical signals transmitted over a specific medium (see §7.2) and mechanical connection to the medium.

The MII interface is both medium independent and application independent. It is defined in §5.2.2.2 as a functional interface, in terms of functional flows and logical signals.

The A-interface is user application protocol specific (e.g., Ethernet, IP). The functional description of the A-interface is presented in §5.2.2.1. The A-interface is for further study.

All interim interfaces are independent of the type of media and are defined as functional (logical) interfaces in the terms of functional flows and logical signals.

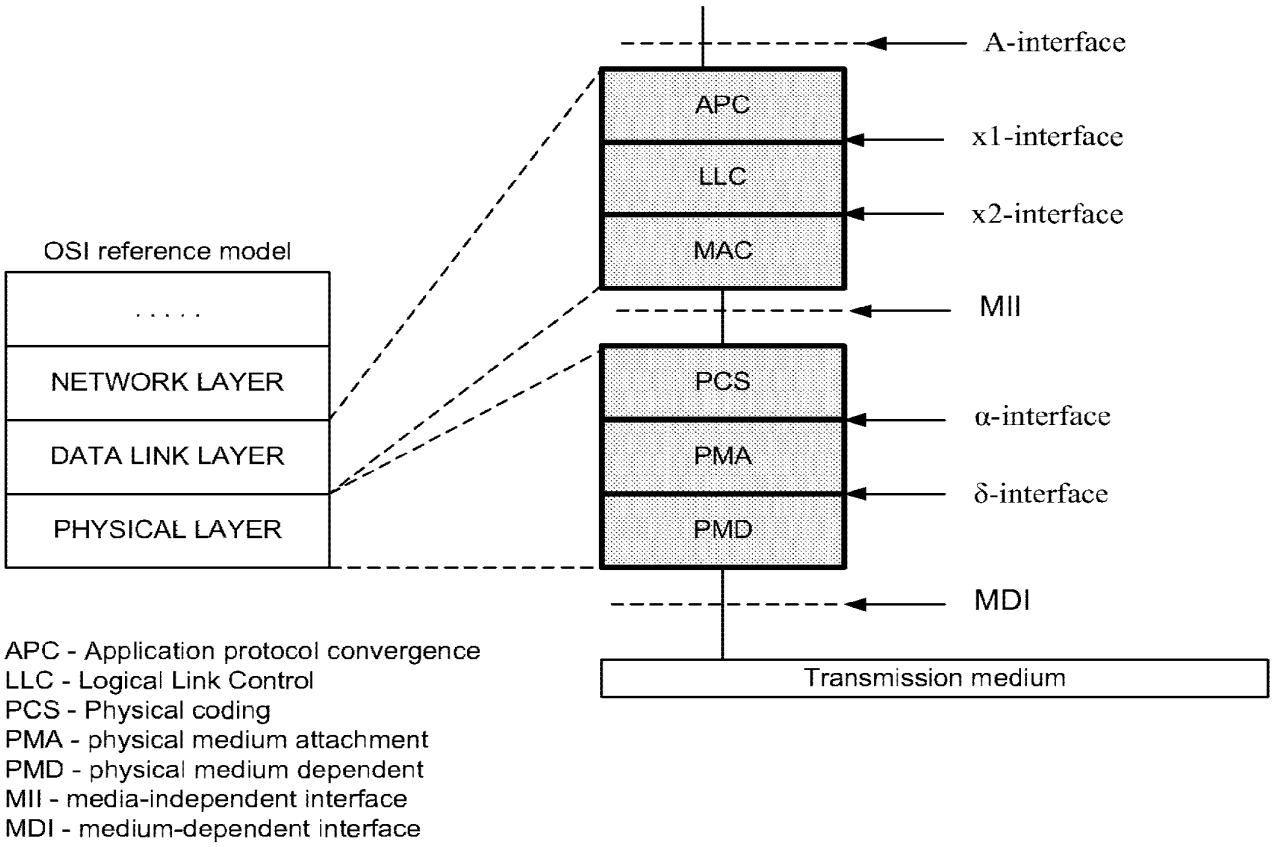


Figure 5-11/G.9960 – Protocol reference model of HN transceiver

The application protocol convergence sub-layer (APC) provides an interface with the application entity (AE), which operates with a client specific protocol, such as ethernet. The APC also provides the bit rate adaptation between the application (client) and the HN.

The logical link control (LLC) sub-layer coordinates transmission of HN nodes in accordance with requests from the domain master. In particular, it is responsible for establishing, managing, resetting and terminating all connections of the node inside the domain. The LLC also enforces Class of Service (CoS) and Quality of Service (QoS) constraints of the flow, defined for its various connections.

The MAC sub-layer controls access of the HN node to the medium using various media access protocols, which are for further study.

The PCS provides bit rate adaptation (data flow control) between the MAC and PHY and encapsulates transmit packets into the PHY frame and adds PHY-related control and management overhead. The PMA provides encoding of PHY frame content for transmission over the medium. The PMD modulates and demodulates PHY frames for transmission over the medium using orthogonal frequency division modulation (OFDM). By implementation, the PMD may include media-dependent adaptors for different media, including frequency shifting for pass-band transmission.

The layers above the data link layer (above the A-interface) are beyond the scope of G.9960. Management functions are not presented in Figure 5-11.

5.2.2 Interfaces - functional description

This section contains the functional description of the G.9960 transceiver interfaces (A, MII, and MDI) in terms of signal flows exchanged between corresponding entities. The description doesn't imply any specific implementation of the transceiver interfaces.

5.2.2.1 A-interface

The A-interface is described in terms of primitives exchanged between the AE and DLL. Two groups of primitives are defined: data primitives and control primitives, as described in Table 5-3. Data primitives represent the data path of the A-interface, while control primitives represent the control path. The format of the primitives is application specific, determined by the AE (application data primitives, ADP).

Table 5-3/G.9960 – A-interface signal flow description

Primitive	Direction	Description
AIF_DATA.REQ	AE → DLL	Data from AE to DLL
AIF_DATA.CNF	DLL→AE	Data confirmation from DLL to AE
AIF_DATA.IND	DLL→ AE	Data from DLL to AE
AIF_CTRL.REQ	AE → DLL	Control from AE to DLL
AIF_CTRL.CNF	DLL → AE	Control confirmation from DLL to AE
AIF_CTRL.IND	DLL → AE	Control from DLL to AE

5.2.2.1.1 AIF_DATA.REQ

The AIF_DATA.REQ primitive defines the transfer of an ADP from the AE to the DLL. The DLL formats the ADP into an MSDU or transfers it to the DLL management.

Semantics of the primitive:

```
AIF_DATA.REQ {
                destination address,
                source address,
                data,
                length,
                service class
                }
```

The destination address may be an individual or a group address identifying the destination.

The source address is an individual address specifically identifying the source of the data unit contained within the ADP.

The data specifies the actual data to be passed.

The length specifies the number of units to be transferred and is specific to the AE.

The service class indicates the quality of service required for this ADP.

5.2.2.1.2 AIF_DATA.CNF

The AIF_DATA.CNF primitive defines a confirmation from the DLL to the AE of the previously received AIF_DATA.REQ primitive and is passed from the DLL to the AE after each received AIF_DATA.REQ.

Semantics of the primitive:

```
AIF_DATA.CNF {
                status
                }
```

The status is a set of parameters (including rejection codes) describing the status of the ADP passed to the DLL in the previous AIF_DATA.REQ primitive.

5.2.2.1.3 AIF_DATA.IND

The AIF_DATA.IND primitive defines the transfer of an ADP from the DLL to the AE. The primitive is transferred to AE whenever the DLL has an ADP ready to be transferred. Semantics of the primitive:

```
AIF_DATA.IND {
                destination address,
                source address,
                data,
                length,
                service class,
                reception status,
                }
```

The destination address may be an individual or a group address identifying the target.

The source address is an individual address specifically identifying the source of the data unit contained within the ADP.

The data specifies the actual data to be passed.

The length specifies the number of units to be transferred and is specific to the AE.

The service class indicates the type of quality of service required for this ADP.

Status shall indicate the validity of the data unit that is delivered via the A-interface to the AE.

5.2.2.1.4 AIF_CTRL.REQ

The AIF_CTRL.REQ primitive defines a control request from the AE to the DLL. The DLL executes the request according to the specified control operation.

Semantics of the primitive:

```
AIF_CTRL.REQ {
                        control operand list
                }
```

The control operand list is specific per each control operation.

5.2.2.1.5 AIF_CTRL.CNF

The AIF_CTRL.CNF primitive defines a confirmation from the DLL to the AE of a previously received AIF_CNTRL.REQ primitive and is passed from the DLL to the AE whenever the confirmation on the received AIF_DATA.REQ is required.

Semantics of the primitive:

AIF_CTRL.CNF {

control operand list

}

The control operand list is specific per each control operation.

5.2.2.1.6 AIF_CTRL.IND

The AIF_CTRL.IND primitive defines a control indication from the DLL to the AE. This primitive may be used to indicate to the AE whether the DLL is ready or not to receive another ADP.

Semantics of the primitive:

AIF_CTRL.IND {

control operand list

}

The control operand list is specific per each control operation.

5.2.2.2 Medium-Independent Interface (MII)

The MII is described in terms of signal flows exchange between the DLL and PHY layer. The MII signal flows are presented in Table 5-4; the direction of each signal flow indicates the entity originating the flow. Both transmit and receive data are exchanged in MAC protocol data units (MPDUs). The format of MPDUs is for further study.

Table 5-4/G.9960 – MII signal flow description

Signal flow	Direction	Description
TX DATA	MAC → PHY	Flow of MPDUs for transmission
TX CLK	PHY → MAC	Transmit timing
RX DATA	PHY → MAC	Flow of received MPDUs
RX CLK	PHY → MAC	Receive timing
RX ERR	PHY → MAC	Error signal accompanies MPDU of a PHY frame received with errors
CRS	PHY → MAC	Carrier sense signal (physical or virtual)
NOTE – Signal flows presented in this table are functional; they are exclusively for descriptive purposes and do not imply any specific implementation.		

The described signal flows indicate the following specifics of the MII:

- the MII bit timing (clock) for both transmit and receive directions is determined by the PHY

- the CRS assists TX DATA flow control in case CSMA is used
- RX_ERR indicates that one or more components of the PHY frame carrying the received MPDU are in error; the DLL is responsible for processing of the packets and deciding which MPDUs to keep, discard, or retransmit.

5.2.2.3 Medium-dependent interface (MDI)

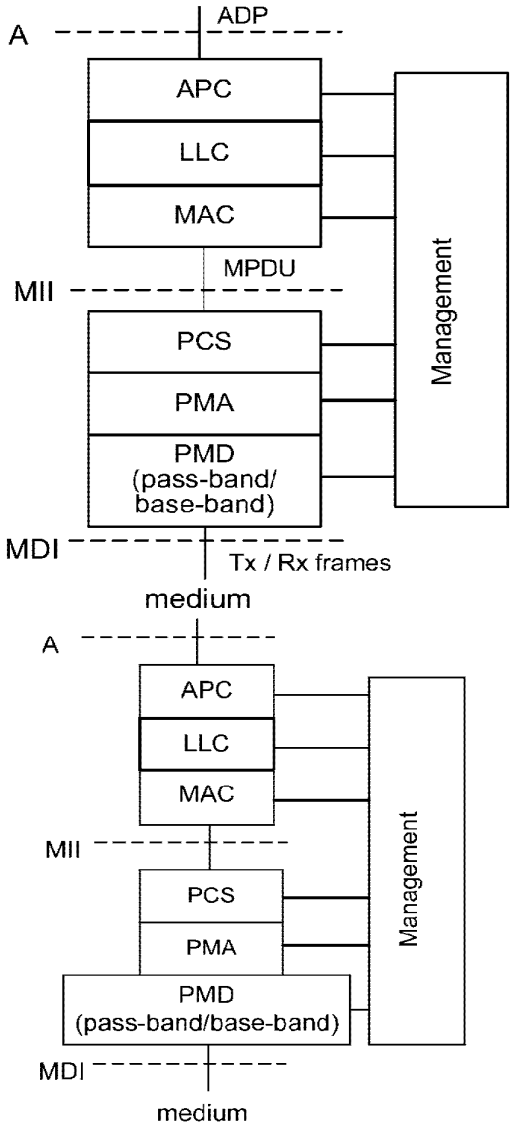
Functional characteristics of the MDI are described by two signal flows:

- transmit signal (TX DATA) is the flow of frames transmitted onto the medium
- receive signal (RX DATA) is the flow of frames received from the medium.

5.2.3 Functional model of an HN transceiver

The functional model of an HN transceiver is presented in Figure 5-12. It addresses a regular node, a master node, and a relay node (including DAP), which differ by their MAC, LLC and upper layer functionalities.

The PMD function depends on the medium on which the transceiver operates. It can be configured for base-band or pass-band operation. The PCS provides bit rate adaptation (data flow control) between the MAC and the PHY and encapsulates transmit MAC frames into PHY frames. The transmit PHY frame is further encoded in the PMA to meet the corresponding PMD. The functionality of the PCS, and the PMA is the same for any medium, but their parameters are medium-specific. By appropriate parameter settings, any HN node can be configured to operate on any type of wiring in both base-band and pass-band modes.



834

835

836 **Figure 5-12/G.9960 – Functional model of HN transceiver**

837

838 The detailed description of the functional model of the PHY layer is presented in §7.1. The detailed
839 description of the functional model of the DLL is for further study.

840

841 **6 Profiles**

842 Profiles are intended to address G.9960 nodes with significantly different levels of complexity.
843 Details are for further study.

7 Physical layer specification

7.1 Media independent specification

7.1.1 Functional model of the PHY

The functional model of the PHY is presented in Figure 7-1. The MII and MDI are, respectively, two demarcation reference points between the PHY and MAC and between the PHY and transmission medium. Internal reference points δ and α, respectively, show separation between the PMD and PMA and between the PCS and PMA.

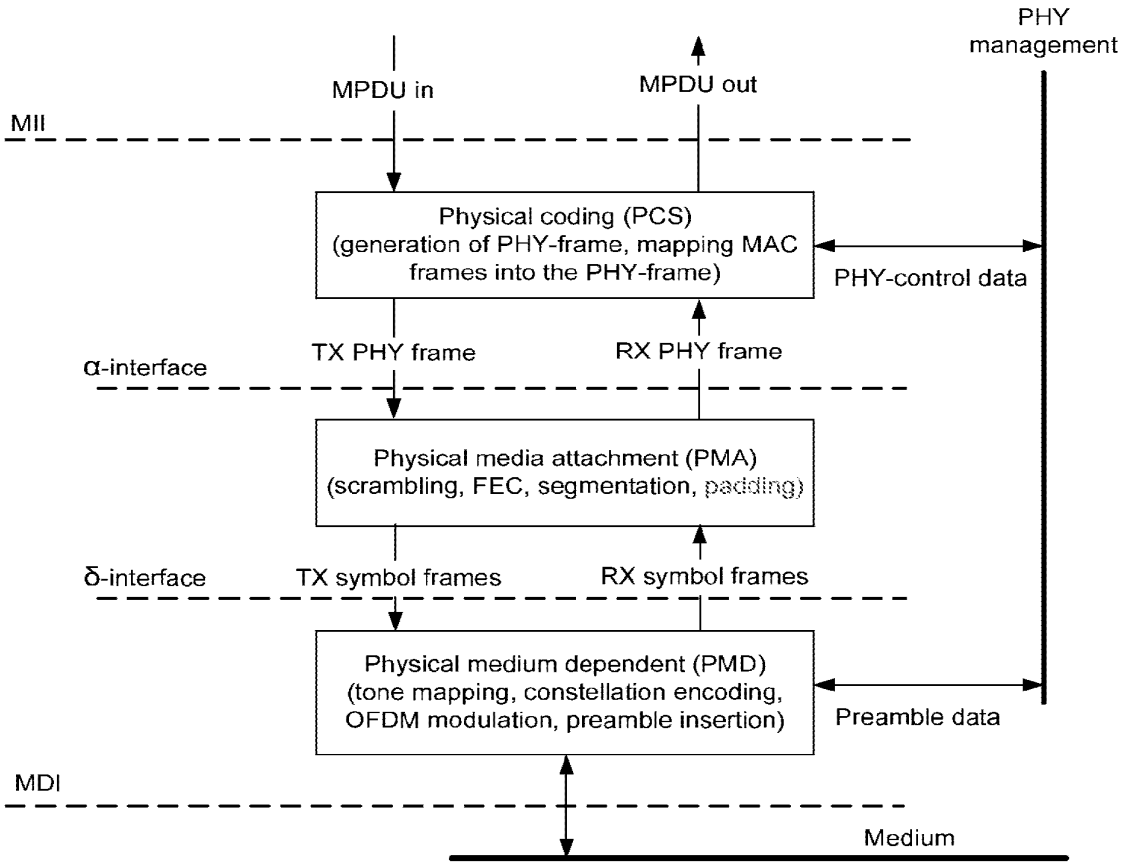


Figure 7-1/G.9960 – Functional model of the PHY

In the transmit direction, data enters the PHY from the MAC via MII by blocks of bytes called MAC protocol data units (MPDUs). The incoming MPDU, whether it belongs to a data frame or a control frame, is mapped into the PHY frame originated in the PCS, scrambled and encoded in the PMA, modulated in the PMD, and transmitted over the medium using OFDM modulation with relevant parameters. In the PMD, a preamble is added to assist synchronization and channel estimation in the receiver.

In the receive direction, frames entering from the medium via the MDI are demodulated and decoded. The recovered MPDUs are forwarded to MAC via the MII. The recovered PHY-frame headers are processed in the PHY to extract the relevant frame parameters specified in §7.1.2.3.

7.1.2 Physical coding sub-layer (PCS)

The functional model of the PCS is presented in Figure 7-2. It is intended to describe in more detail the PCS functional block presented in Figure 7-1.

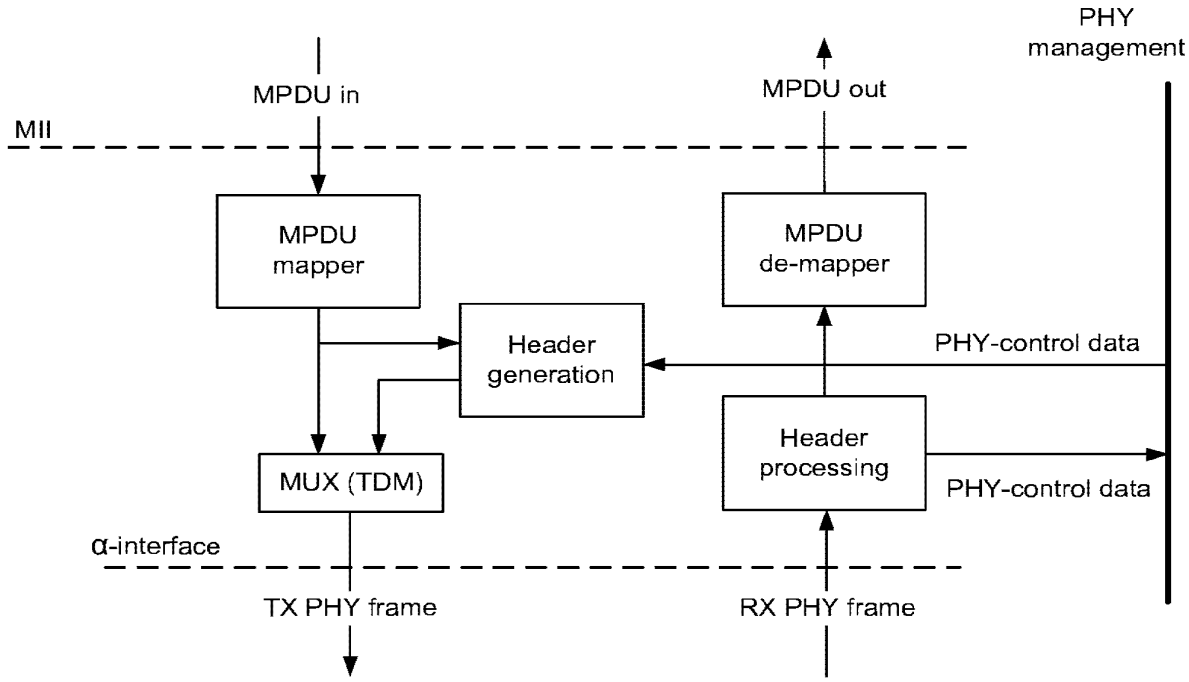


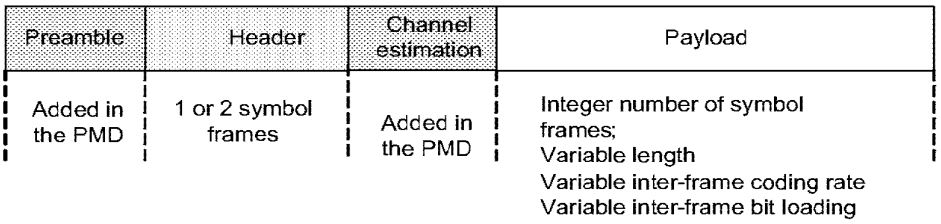
Figure 7-2/G.9960 – Functional model of PCS

In the transmit direction, the incoming MPDU is mapped into a payload field of a PHY frame (§7.1.2.1) as described in §7.1.2.2. Further, the PHY-frame header (§7.1.2.3) is added to form a TX PHY frame. The TX PHY frame is passed via the α-interface for further processing in the PMA.

In the receive direction, the decoded PHY-frame payload and header are processed and originally transmitted MPDUs are recovered from the payloads of properly received PHY frames and submitted to the MII. Relevant control information conveyed in the PHY-frame header is processed and submitted to the PHY management entity, Figure 7-2.

7.1.2.1 PHY frame

The format of the PHY frame is presented in Figure 7-3. The PHY frame at the α-interface includes header, and payload. Preamble is added to the PHY frame in the PMD, as described in §7.1.4.5. Preamble does not bear any user or management data and is intended for synchronization and initial channel estimation.



882
883

884 **Figure 7-3/G.9960 – Format of the PHY frame**

885 The PHY-frame header and payload shall each contain an integer number of OFDM symbols.

886 The length of the PHY-frame header always fits integer number of symbols and is transmitted using
887 a single pre-defined set of modulation and coding parameters (see §7.1.3.4).

888 The length of the payload may vary from frame to frame; payload may be of zero length. For
889 payload, different coding parameters and bit loading can be used in different frames, depending on
890 channel/noise characteristics and QoS requirements.

891 **7.1.2.2 MPDU mapping**

892 The bits of the MPDU shall be mapped into the payload in ascending sequential order. The first bit
893 of the MPDU shall be the first transmitted bit of the payload.

894 **7.1.2.3 PHY-frame header**

895 The PHY-frame header is PHY_H bits long and is composed of a common part and a variable part.
896 The common part contains fields that are common for all PHY-frame types. The variable part
897 contains fields according to the PHY-frame type. PHY-frame type is indicated by the FT field. The
898 PAD fields fit the length of the header of different PHY frame-types to the standard values of PHY_H
899 bits. The content of the header is protected by the 16-bit header check sequence (HCS).

900 The fields of the PHY-frame header are defined in Table 7-1

901

902 **Table 7-1/G.9960 – PHY-frame header fields**

Field	Octet	Field Size [Bits]	Description	
FT	0	4	Frame type	Common part
DOD	0	4	Domain ID	
SID	1	8	The device ID of the source node	
DID	2	8	The device ID of the destination node	
MI	3	1	Multicast indication identifies whether the DID is a multicast destination	
PHI	3	1	Post header indication identifies whether the first payload symbol after the header is a PRBS symbol or a data symbol	
Reserved	3	6	Reserved by ITU-T	
Duration	4-5	16	The PHY frame transmission duration	
…	6-18			Variable part
HCS	19-20	16	Header check sequence	Common part

903

904 **7.1.2.3.1 Common part fields**

905 **7.1.2.3.1.1 Frame Type (FT)**

906 The Frame type (FT) field is a 4-bit field which indicates the type of the PHY frame transmitted.

907

908 Table 7-2 describes the PHY-frame types.

Table 7-2/G.9960 –PHY-frame types

Type	Value	Description
MAP	0	MAP frame
MSG	1	Data and management frame
ACK	2	ACK control frame
RTS	3	RTS control frame
CTS	4	CTS control frame
RMAP	5	Repeated MAP frame
PROBE	6	Probe frame
ACKRQ	7	ACK retransmission request frame
Reserved	8-15	Reserved for future use

7.1.2.3.1.2 Domain ID (DOD)

The DOD is a 4-bit field that identifies the domain to which the source and destination devices of the PHY frame belong. DOD shall be represented as a 4-bit unsigned integer in the valid range from 0 to 15. The method for choosing DOD is for further study.

7.1.2.3.1.3 Source ID (SID)

SID is the device ID that was assigned to the G.9960 source node of the PHY frame during its registration. The SID shall be represented by an 8-bit unsigned integer with valid values in the range from 0 to 250. Value 0 shall be used as the default device ID of a node attempting to join the network.

7.1.2.3.1.4 Destination ID (DID)

The DID is the DEVICE_ID value identifying the G.9960 destination node of the PHY frame. The DID shall be represented by an 8-bit unsigned integer with valid values in the range from 0 to 250. It could be equal to the device ID assigned during node registration, or to the value reserved for broadcast ID or multicast ID.

7.1.2.3.1.5 Multicast Indication (MI)

The multicast indication shall be set when the DID is a multicast/broadcast destination DEVICE_ID.

7.1.2.3.1.6 Post Header Indication (PHI)

The PHI bit, when set, shall indicate to all nodes that the first payload symbol following the header is a PRBS symbol. Otherwise the first payload symbol shall be a data symbol.

7.1.2.3.1.7 Duration

The duration field contains a 16-bit unsigned integer that shall describe the total PHY frame transmission time (preamble, header and payload) for virtual carrier sensing in multiples of 0.25μsec.

In the case of an RTS frame, the total duration indicated in this field shall represent the total duration of the following sequence:

- The transmission time of the RTS PHY frame
- The transmission time of the CTS PHY frame
- The PHY frame that follows the CTS PHY frame, and
- The two inter-frame gaps between the above frames
- If ACK is required, the duration of the inter-frame gap and the ACK-frame

In the case of a CTS frame, the total duration indicated in this field shall repeat the duration expressed in the preceding RTS PHY frame minus the RTS PHY frame transmission time and the inter-frame gap that follows the RTS PHY frame.

7.1.2.3.1.8 Header check sequence (HCS)

The HCS field is intended for PHY-frame header verification. The HCS is a 16-bit cyclic redundancy check (CRC) and shall be computed over all the fields of the PHY-frame header in the order they are transmitted, starting with the MSB of the frame type (FT) field and ending with the LSB of the last field of the PHY Frame.

The HCS shall be computed using the following generator polynomial of degree 16:

$$G(x) = x^{16} + x^{12} + x^5 + 1.$$

The value of the HCS shall be the remainder after the contents (treated as a polynomial where the first input bit is associated with the highest degree, $X^{PHYH-17}$, where PHY_H is the header length in bits , and the last input bit is associated with X^0) of the calculation fields is multiplied by x^{16} and then divided by $G(x)$.

The HCS field shall be transmitted starting with the coefficient of the highest order term (MSB).

7.1.2.3.2 Variable part specific fields

The following paragraph details the specific PHY-frame header fields for each PHY-frame type variable part.

For some frame types, a pad may be required at the end of frame type specific fields to fit the PHY-frame header variable part size.

7.1.2.3.2.1 MSG PHY-frame type specific fields

Table 7-3 lists the MSG frame type specific PHY-frame header fields.

966 **Table 7-3/G.9960 – MSG PHY-frame type specific fields**

Field	Field size [bits]
MSTRDTCT	1
RPRQ	2
RTSRQ	1
BRURQ	For further study
BLKSZ	2
FEC_RATE	3
FLOW_ID/PRI	8
REP	3
FCF	3
SI	4
FRMSN	2
TPN	11
Pad	padding up to PHY_H bits

967 **7.1.2.3.2.1.1 "Master is detected" indication (MSTRDTCT)**

968 MSTRDTCT indicates reception of a MAP. It is a 1-bit field that shall be set by a node, in each
969 PHY-frame header it transmits, when this node has received a MAP (either directly from the
970 domain master or repeated MAP) that the current MAC cycle is associated with. This indication
971 shall be used by nodes (including the backup domain master if it exists) to determine whether the
972 current domain master has failed.

973 **7.1.2.3.2.1.2 Reply required (RPRQ)**

974 RPRQ instructs the receiver whether to respond with acknowledgement for this PHY frame. It is a
975 2-bit field that shall be coded as shown in Table 7-4.

976 **Table 7-4/G.9960 – RPRQ field possible values**

RPRQ value	Interpretation
00	The receiver shall not acknowledge this PHY frame
01	The receiver shall acknowledge via an Imm-ACK frame
10 - 11	Reserved by ITU-T

977 **7.1.2.3.2.1.3 RTS/CTS required (RTSRQ)**

978 RTSRQ indicates whether to use the RTS/CTS sequence. It is a 1-bit field. When RTSRQ is set to
979 one, all nodes shall use the RTS/CTS sequence when communicating with the node that set RTSRQ
980 for all PHY frames after the current PHY frame, until this node indicates otherwise by setting the
981 bit to zero.

982 **7.1.2.3.2.1.4 Bandwidth reservation update request (BRURQ)**

983 This field is for further study.

7.1.2.3.8.1.5 Block size (BLKSZ)

BLKSZ indicates the information block size of the FEC codeword that is used by the transmitter for the payload of the PHY frame. It is a 2-bit field that shall be coded as shown in Table 7-5.

Table 7-5/G.9960 – Interpretation of the BLKSZ field

BLKSZ value	Interpretation
00	for the 120 byte information block size used for payload
01	for the 540 byte information block size used for payload
10-11	Reserved by ITU-T

7.1.2.3.2.1.6 FEC_RATE

FEC_RATE indicates the FEC coding rate that is used for encoding of the payload. It is a 3-bit unsigned integer field that shall be coded as shown in Table 7-6.

Table 7-6/G.9960 – Interpretation of the FEC_RATE field

FEC_RATE value	Interpretation
000	Reserved by ITU
001	1/2
010	2/3
011	5/6
100	16/18
101	20/21
110-111	Reserved by ITU

7.1.2.3.2.1.7 Flow identifier (FLOW_ID) and priority (PRI)

FLOW_ID/PRI is an 8-bit unsigned integer field that shall contain the FLOW_ID of the blocks aggregated in the frame (field values in the range 8-254), or the priority of the blocks aggregated in the frame if the field value is between 0 and 7.

7.1.2.3.2.1.8 Repetitions (REP)

REP indicates the nominal number of repetitions that were used for encoding the payload in this PHY frame. It is a 3-bit unsigned integer field that shall be coded as shown in Table 7-7.

1001 **Table 7-7/G.9960 – Repetitions field possible values**

REP value	Interpretation
000	Reserved by ITU-T
001	1 (no repetitions)
010	2
011	3
100	4
101	6
110 - 111	Reserved by ITU-T

1002

1003 **7.1.2.3.2.1.9 FEC concatenation factor (FCF)**

1004 FCF indicates the values of parameters *H* and z (see §7.1.3.3.1). It is a 3-bit unsigned integer field
1005 that shall be coded as shown in Table 7-8.

1006 **Table 7-8/G.9960 – FEC concatenation factor (FCF) possible values**

Value	*H*	z
000	1	0
001	Reserved by ITU-T	Reserved by ITU-T
010	2	0
011	2	1
100	4	0
101	4	1
110	4	2
111	4	3

1007

1008 **7.1.2.3.2.1.10 Scrambler initialization (SI)**

1009 SI contains the scrambler initialization value ($C_4C_3C_2C_1$) that was used by the transmitter for this
1010 frame. It is a 4-bit field that shall be used to initialize the scrambler, as described in §7.1.3.1.

1011 **7.1.2.3.2.1.11 Frame sequence number (FRMSN)**

1012 FRMSN holds the transmitted frame sequence number sent to the same destination (DID). It is a 2-
1013 bit unsigned integer field.

1014 The FRMSN shall be initialized to zero upon the first PHY frame containing payload sent for a
1015 certain DID and shall be incremented by one upon each additional PHY frame containing payload
1016 sent to the same DID. When the FRMSN value exceeds the maximum value of 3, the FRMSN shall
1017 wrap-around to zero.

1018 **7.1.2.3.2.1.12 Transmission profile number (TPN)**

1019 TPN includes parameters that, in conjuction with SID, allow the receiver to determine the
1020 transmission profile used by the transmitter for the particular PHY frame.

1021 One or more TPN values can be used between the same transmitter and receiver for different flows
1022 or for different positions within the MAC cycle of the same flow.

It is an 11-bit field that shall indicate the bit allocation table (BAT) of the current PHY frame via the BAT identifier (BAT_ID), the sub-carrier grouping (see §7.1.4.2.4) via the grouping identifier (GRP_ID), and the guard interval used for payload via the guard interval identifier (GI_ID) as shown in Table 7-9.

Table 7-9/G.9960 – Interpretation of the TPN field

Field		Bits	Description
BAT_ID		10:6	Bit allocation table identifier (see Table 7-20)
GRP_ID		5:3	Sub-carrier grouping identifier (see Table 7-10)
GI_ID		2:0	Identifier of the guard interval used for payload (see Table 7-11)

Table 7-10/G.9960 – Format of the GRP_ID

GRP_ID value	[Bits]	Description
0	000	Default - No sub-carrier grouping
1	001	Sub-carrier grouping of 2 sub-carriers
2	010	Sub-carrier grouping of 4 sub-carriers
3	011	Sub-carrier grouping of 8 sub-carriers
4	100	Sub-carrier grouping of 16 sub-carriers
5-7	101-111	Reserved by ITU-T

Table 7-11/G.9960 – Format of the GI_ID

GI_ID value	[Bits]	Description
0-6	000-110	N_{GI} guard interval [samples] $k \times N/32$, $k = 1, 2, 3, \ldots, 7$ where k = GI_ID+1, N is the size of the DFT
7	111	$k = 8$ (GI_ID=7) $N_{GI} = N_{GI\text{-}DF} = N/4$

7.1.2.3.2.2 ACK PHY-frame type specific fields

For further study.

7.1.2.3.2.3 MAP and RMAP PHY-frame type specific fields

Table 7-12 lists the MAP and RMAP frame type specific PHY-frame header fields.

Table 7-12/G.9960 – MAP and RMAP PHY-frame type specific fields

Field	Size in bits
NTR	32
SI	4
Pad	padding up to PHY_H

7.1.2.3.2.3.1 Network time reference (NTR)

NTR is used for synchronizing nodes to the domain master transmit clock. It is a 32-bit unsigned integer field. The NTR shall indicate the time stamp of the first sample of the first OFDM symbol of a MAP or RMAP PHY frame that is sent according to the transmitting node's clock with a resolution of 10ns.

The NTR value shall use modulo arithmetic (modulo 2^{32}) where G.9960 nodes shall be capable to follow the network's clock based on the NTR value.

NOTE – Nodes that are hidden from the domain master shall synchronize to the domain master time via the RMAP PHY frame received from another G.9960 node that repeats the domain master's MAP.

7.1.2.3.2.3.2 Scrambler initialization (SI)

SI contains the scrambler initialization value ($C_4C_3C_2C_1$) that was used by the domain master for this frame. It is a 4-bit field that shall be used to initialize the scrambler, as described in §7.1.3.1.

7.1.2.3.2.4 RTS PHY-frame type specific fields

Table 7-13 lists the RTS PHY-frame type specific PHY-frame header fields:

Table 7-13/G.9960 – RTS PHY-frame type specific fields

Field	Size in bits
CID	8
Pad	padding up to PHY_H

7.1.2.3.2.4.1 CTS proxy ID (CID)

CID contains the DEVICE_ID of the node that should respond in CTS for multicast traffic. It is an 8-bit unsigned integer field with valid values in the range from 1 to 250.

7.1.2.3.2.5 CTS PHY-frame type specific fields

Specific fields of the CTS PHY-frame type are listed in Table 7-14.

Table 7-14/G.9960 – Specific fields of the CTS PHY-frame type

Field	Size in bits
Pad	padding up to PHY_H

7.1.2.3.2.6 PROBE PHY-frame type specific fields

Table 7-15 lists the PROBE PHY-frame type specific PHY-frame header fields:

Table 7-15/G.9960 – PROBE PHY-frame type specific fields

Field	Size in bits
PRBTYPE	4
PRBSYM	5
APSDC	5
Pad	padding up to PHY_H

7.1.2.3.2.6.1 PROBE frame type (PRBTYPE)

PRBTYPE indicates the type of the PROBE frame. It is a 4-bit field that shall be coded as shown in Table 7-16.

Table 7-16/G.9960 – PRBTYPE field values

Value	Interpretation
0000	Silent PROBE frame
0001	Channel assessment PROBE frame
0010-1111	Reserved by ITU-T

7.1.2.3.2.6.2 Probe symbols (PRBSYM)

PRBSYM indicates the number of OFDM payload symbols in the PROBE frame. It is a 5-bit field that shall be coded as shown in Table 7-17

Table 7-17/G.9960 – PRBSYM field values

Value	Interpretation
00000	4 Payload symbols
00001	8 Payload symbols
00010	12 Payload symbols
00011	16 Payload symbols
….	….
01111	64 Payload symbols
1xxxx	Reserved by ITU-T

7.1.2.3.2.6.3 Actual PSD ceiling (APSDC)

APSDC indicates the PSDC value that is used in the current transmitting signal. The field shall be coded as a 5-bit unsigned value. The valid values are in the range from 0 to 25, plus 0x1F. Values from 0 to 25 correspond to actual an PSD ceiling in the range of –50 dBm/Hz to –100 dBm/Hz in 2 dB steps. The special value 0x1F indicates that no PSD ceiling is applied.

7.1.2.3.2.7 ACKRQ frame type specific fields

For further study.

7.1.3 Physical medium attachment (PMA) sub-layer

The functional model of the PMA is presented in Figure 7-4. It is intended to describe in more detail the PMA functional block presented in Figure 7-1.

In the transmit direction, the incoming PHY frame (except for preamble and channel estimation symbols) at the α-interface has a format as defined in §7.1.2. Both the header bits and the payload bits of the incoming frame are scrambled as described in §7.1.3.1. The header bits of the incoming frame are encoded as described in §7.1.3.4. The payload bits are encoded, as described in §7.1.3.3. The parameters of payload encoder are controlled by the PHY management entity.

After encoding, the header and payload are each segmented into an integer number of symbol frames as described in §7.1.3.5.1. The obtained symbol frames of the header and the payload are submitted to the PMD (at the δ-interface) for modulation and transmission over the medium.

In the receive direction, all necessary inverse operations of decoding, and de-scrambling are performed on the received symbol frames. The recovered PHY-frame header and payload are submitted to the α-interface for further processing in the PCS.

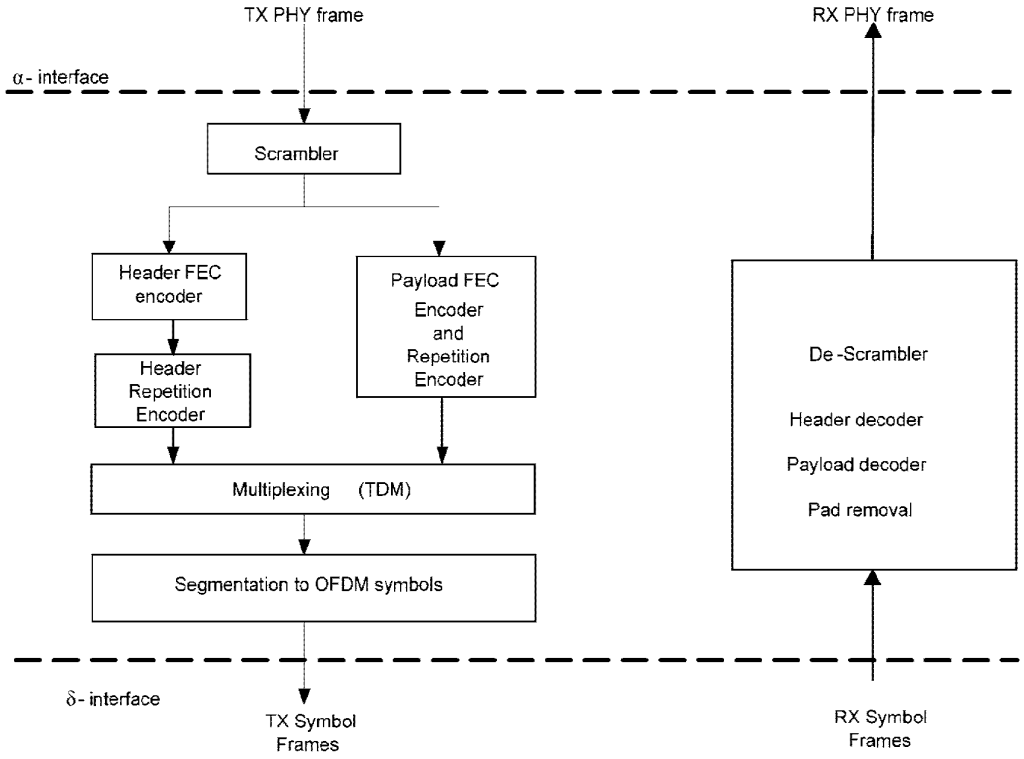


Figure 7-4/G.9960 – Functional model of PMA

7.1.3.1 Scrambling

All data starting from the first bit of the PHY-frame header and ending by the last bit of the payload shall be scrambled with a pseudo-random sequence generated by the linear feedback shift register (LFSR) with the polynomial $p(x)=x^{23}+x^{18}+1$, as shown in Figure 7-5.

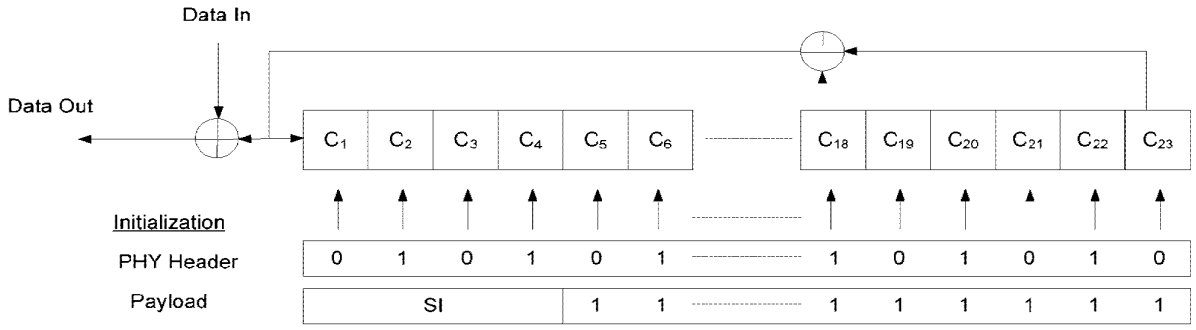


Figure 7-5/G.9960 – Scrambler; $p(x) = x^{23}+x^{18}+1$

The LFSR generator shall be initialized at the first bit of the header with the initialization vector equal to 0x2AAAAA (where the LSB corresponds to C_1); this initialization is used for scrambling of the header data. A second initialization may be performed immediately after the header, at the first bit of the payload, and is used for scrambling of the payload data. For the second initialization, the first four bits of the LFSR (C_1 to C_4) shall be set to the value of SI (Scrambler Initialization), while all other bits C_5 to C_{23} shall be initialized to 1. The value of SI = $C_4C_3C_2C_1$ is communicated in the header as described in §7.1.2.3.

The special value 0x0 for SI indicates that the scrambler is not re-initialized between the header and payload. The initialization of the SI field to values other than the special value is optional.

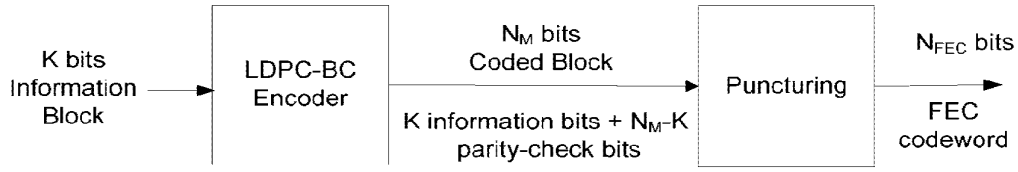
NOTE – the method for generating SI values is beyond the scope of this Recommendation.

7.1.3.2 FEC encoding

The FEC encoding scheme is shown in Figure 7-6. The scheme consists of a systematic QC-LDPC-BC encoder and a puncturing mechanism. The parameters of the FEC encoding scheme are:

- the number of incoming information bits, K (information block of bits);
- the number of coded bits, N_M (coded block of bits);
- the number of parity-check bits, N_M-K;
- the number of output bits, $N_{FEC} \leq N_M$, (FEC codeword, whose size depends on the puncturing pattern);
- the mother coding rate, $R_M = K/N_M$, defined as the coding rate before puncturing.
- the coding rate, $R = K/N_{FEC}$, defined as the coding rate after puncturing.

The information block size shall be one of the values specified in Table 7-19.



1143

1144 **Figure 7-6/G.9960 – FEC Encoder**

1145 The encoder shall support mother codes with rates $R_M = 1/2$, $R_M = 2/3$ and $R_M = 5/6$. From
1146 these mother codes, codes with higher coding rates shall be obtained through puncturing, as
1147 described in §7.1.3.2.1.1. The Puncturing block shall support patterns providing all coding rates
1148 presented in Table 7-19.

1149

1150 The coding rate of the mother code, $R_M = K / N_M$, is determined by a $(N_M - K) \times N_M$ size parity-
1151 check matrix $\mathbf{H}$ composed by an array of $c \times t$ circulant $b \times b$ sub-matrices $\mathbf{A}_{i,j}$:

1152
$$\mathbf{H} = \begin{bmatrix} \mathbf{A}_{1,1} & \mathbf{A}_{1,2} & \cdots & \mathbf{A}_{1,t} \\ \mathbf{A}_{2,1} & \mathbf{A}_{2,2} & \cdots & \mathbf{A}_{2,t} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{A}_{c,1} & \mathbf{A}_{c,2} & \cdots & \mathbf{A}_{c,t} \end{bmatrix}.$$

1153

1154 The parameters c, t $(0 < c \le t)$ imply a rate $R_M = (t - c)/t$. By selecting different sets of
1155 c, t ,different rates can be obtained.

1156 The sub-matrices $\mathbf{A}_{i,j}$ are either a rotated identity or a zero matrices and have a size of $b \times b$, where
1157 parameter $b = N_M / t$ is called the *expansion factor* of $\mathbf{H}$ and controls the code block size, N_M.

1158

1159 The parity-check matrix, **H**, is described in its compact form:

1160
$$\mathbf{H}_c = \begin{bmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,t} \\ a_{2,1} & a_{2,2} & \cdots & a_{2,t} \\ \vdots & \vdots & \ddots & \vdots \\ a_{c,1} & a_{c,2} & \cdots & a_{c,t} \end{bmatrix}$$

1161 A zero sub-matrix in position (i, j) is labeled with $a_{i,j} = -1$, and a rotated identity sub-matrix is
1162 labelled with a positive integer number $a_{i,j}$ defining the number of right column shifts $\hat{a}_{i,j}$ modulo b
1163 of the identity matrix. The relation between $a_{i,j}$ and $\hat{a}_{i,j}$ is given by

1164
$$\hat{a}_{i,j} = \begin{cases} a_{i,j} & a_{i,j} < 0, \\ \left\lfloor a_{i,j} \cdot \dfrac{b}{96} \right\rfloor & a_{i,j} \ge 0. \end{cases}$$

1165 where $\lfloor x \rfloor$ is the integer part of variable x.

The compact form of parity-check matrix of mother code H_c with rate R_M=1/2 (t = 24, c = 12) shall be:

```
-1 94 73 -1 -1 -1 -1 -1 55 83 -1 -1  7  0 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 27 -1 -1 -1 22 79  9 -1 -1 -1 12 -1  0  0 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 24 22 81 -1 33 -1 -1 -1  0 -1 -1  0  0 -1 -1 -1 -1 -1 -1 -1 -1
61 -1 47 -1 -1 -1 -1 -1 65 25 -1 -1 -1 -1 -1  0  0 -1 -1 -1 -1 -1 -1 -1
-1 -1 39 -1 -1 -1 84 -1 -1 41 72 -1 -1 -1 -1 -1  0  0 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 46 40 -1 82 -1 -1 -1 79  0 -1 -1 -1 -1  0  0 -1 -1 -1 -1 -1
-1 -1 95 53 -1 -1 -1 -1 -1 14 18 -1 -1 -1 -1 -1 -1 -1  0  0 -1 -1 -1 -1
-1 11 73 -1 -1 -1  2 -1 -1 47 -1 -1 -1 -1 -1 -1 -1 -1 -1  0  0 -1 -1 -1
12 -1 -1 -1 83 24 -1 43 -1 -1 -1 51 -1 -1 -1 -1 -1 -1 -1 -1  0  0 -1 -1
-1 -1 -1 -1 -1 94 -1 59 -1 -1 70 72 -1 -1 -1 -1 -1 -1 -1 -1 -1  0  0 -1
-1 -1  7 65 -1 -1 -1 -1 39 49 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1  0  0
43 -1 -1 -1 -1 66 -1 41 -1 -1 -1 26  7 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1  0
```

The compact form of parity-check matrix of mother code H_c with rate R_M=2/3 (t = 24, c = 8) shall be:

```
 2 -1 19 -1 47 -1 48 -1 36 -1 82 -1 47 -1 15 -1 95  0 -1 -1 -1 -1 -1 -1
-1 69 -1 88 -1 33 -1  3 -1 16 -1 37 -1 40 -1 48 -1  0  0 -1 -1 -1 -1 -1
10 -1 86 -1 62 -1 28 -1 85 -1 16 -1 34 -1 73 -1 -1 -1  0  0 -1 -1 -1 -1
-1 28 -1 32 -1 81 -1 27 -1 88 -1  5 -1 56 -1 37 -1 -1 -1  0  0 -1 -1 -1
23 -1 29 -1 15 -1 30 -1 66 -1 24 -1 50 -1 62 -1 -1 -1 -1  0  0 -1 -1 -1
-1 30 -1 65 -1 54 -1 14 -1  0 -1 30 -1 74 -1  0 -1 -1 -1 -1 -1  0  0 -1
32 -1  0 -1 15 -1 56 -1 85 -1  5 -1  6 -1 52 -1  0 -1 -1 -1 -1 -1  0  0
-1  0 -1 47 -1 13 -1 61 -1 84 -1 55 -1 78 -1 41 95 -1 -1 -1 -1 -1 -1  0
```

The compact form of parity-check matrix of mother code H_c with rate R_M=5/6 (t = 24, c = 4) shall be:

```
 1 25 55 -1 47  4 -1 91 84  8 86 52 82 33  5  0 36 20  4 77 80  0 -1 -1
-1  6 -1 36 40 47 12 79 47 -1 41 21 12 71 14 72  0 44 49  0  0  0  0 -1
51 81 83  4 67 -1 21 -1 31 24 91 61 81  9 86 78 60 88 67 15 -1 -1  0  0
50 -1 50 15 -1 36 13 10 11 20 53 90 29 92 57 30 84 92 11 66 80 -1 -1  0
```

The codeword at the output of the Puncturing block is of size $N_{FEC} \leq N_M$. The bits shall be output in the ascending order of codeword indices determined by vector **v'** (see §7.1.3.2.1.1); with this order the first information bit incoming the encoder will be the first at the output of the puncturing.

7.1.3.2.1 Encoder

The encoder shall support coded block sizes and rates presented in Table 7-19. The parity-check matrix **H** used to encode a block of information bits is selected according to the mother code indicated in Table 7-19.

The encoding process shall be as follows:

1. A group of incoming K information bits $\mathbf{u} = [u_0, u_1, ..., u_{K-1}]$ are collected and copied to the output of the encoder to form a block of systematic code bits.

2. N_M-K parity-check bits, $\mathbf{p} = [p_0,...,p_{N_M-K-1}]$, are computed using the parity-check matrix $\mathbf{H}$ and the information block $\mathbf{u}$. The resulting coded block $\mathbf{v} = [\mathbf{u}\,|\,\mathbf{p}]$ shall satisfy the parity check equations $\mathbf{vH}^T = \mathbf{0}$. Here $\mathbf{0}$ is a zero row vector of dimension N_M-K.
3. The N_M-K parity check bits $\mathbf{p}$ are copied to the output of the encoder as a block of parity-check bits $\mathbf{p} = [p_0,...,p_{N_M-K-1}]$ to form the output coded block $\mathbf{v} = [\mathbf{u}\,|\,\mathbf{p}] = [v_0, v_1,..., v_{N_M-1}]$
4. The output of the encoder $\mathbf{v}$ is the input to the Puncturing block (see Figure 7-6)

NOTE – One method of encoding is to determine a systematic generator matrix $\mathbf{G}$ from $\mathbf{H}$ such that $\mathbf{GH}^T = \mathbf{0}$. A K-bit information block $\mathbf{u} = [u_0, u_1,..., u_{K-1}]$ can be encoded by the systematic generator matrix $\mathbf{G}$ via the operation $\mathbf{v} = \mathbf{uG}$ to become a N_M-bit coded block $\mathbf{v} = [v_0, v_1,..., v_{N_M-1}] = [\mathbf{u}\,|\,\mathbf{p}]$, where $\mathbf{p} = [p_0,..., p_{N_M-K-1}]$ are the parity-check bits. Encoding an LDPC code from $\mathbf{G}$ can be quite complex. However, the QC-LDPC-BC codes specified here are such that very low complexity encoding directly from $\mathbf{H}$ is possible.

7.1.3.2.1.1 Puncturing

Puncturing shall discard some of the coded block bits to achieve a higher coding rate (R). Puncturing is applied to both information and parity-check bits. The puncturing block uses puncturing patterns specified in Table 7-18. The puncturing patterns are denoted as $\mathbf{pp}_T^{(i)}$, where T is the length of the puncturing pattern and i is the number of zeros in the pattern.

Table 7-18/G.9960 – Puncturing patterns

	Puncturing pattern
$\mathbf{pp}_{16}^{(0)}$	[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1]
$\mathbf{pp}_{16}^{(1)}$	[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0]
$\mathbf{pp}_{1152}^{(144)}$	[1 1 ⋯ 1 (240) 0 0 ⋯ 0 (48) 1 1 ⋯ 1 (720) 0 0 ⋯ 0 (96) 1 1 ⋯ 1 (48)]
$\mathbf{pp}_{5184}^{(648)}$	[1 1 ⋯ 1 (216) 0 0 ⋯ 0 (216) 1 1 ⋯ 1 (4320) 0 0 ⋯ 0 (432)]

NOTE:

The pattern $\mathbf{pp}_{16}^{(0)}$ doesn't result in any coding rate changes and is introduced to be consistent with the puncturing notation.

The coded block $\mathbf{v}$ incoming the puncturing block shall be processed using the puncturing pattern $\mathbf{pp}_T^{(i)}$ as follows:

For the pattern $\mathbf{pp}_T^{(i)} = [pp_0^{(i)},...,pp_{T-1}^{(i)}]$, the puncturing block shall omit all incoming coded bits $v_t, t = 0,...,N_M - 1$ for which $pp_{t \bmod T}^{(i)} = 0$. Hence, the resulting output FEC codeword will be $\mathbf{v}' = [v'_0, v'_1,..., v'_{N_{FEC}-1}]$ with $N_{FEC} \leq N_M$.

7.1.3.2.2 FEC encoding parameters

The FEC encoding scheme shall support encoding parameters specified in Table 7-19.

Table 7-19/G.9960 – FEC encoding parameters

	Coding rate, R	Information block size, K	Puncturing pattern, pp	Mother code rate, R_M	FEC codeword size, N_{FEC}
For Header	1/2	$PHY_H = 168$	$\mathbf{pp}_{16}^{(0)}$	1/2	336
For Payload	1/2	960	$\mathbf{pp}_{16}^{(0)}$	1/2	1920
	1/2	4320	$\mathbf{pp}_{16}^{(0)}$	1/2	8640
	2/3	960	$\mathbf{pp}_{16}^{(0)}$	2/3	1440
	2/3	4320	$\mathbf{pp}_{16}^{(0)}$	2/3	6480
	5/6	960	$\mathbf{pp}_{16}^{(0)}$	5/6	1152
	5/6	4320	$\mathbf{pp}_{16}^{(0)}$	5/6	5184
	16/18	960	$\mathbf{pp}_{16}^{(1)}$	5/6	1080
	16/18	4320	$\mathbf{pp}_{16}^{(1)}$	5/6	4860
	20/21	960	$\mathbf{pp}_{1152}^{(144)}$	5/6	1008
	20/21	4320	$\mathbf{pp}_{5184}^{(648)}$	5/6	4536

7.1.3.3 Payload encoding

The functional model of the payload encoder is presented in Figure 7-7. It contains an FEC encoder and a Payload Repetition Encoder (PRE) to support robust communication mode (RCM).

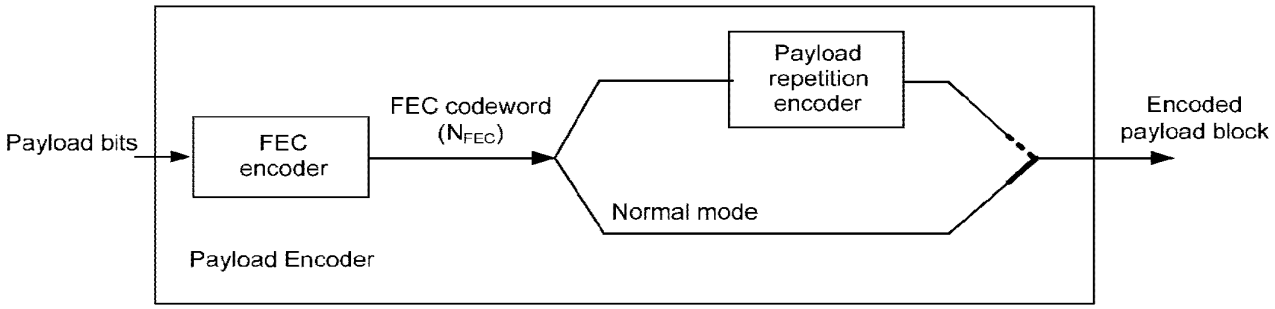


Figure 7-7/G.9960 – Functional diagram of the Payload Encoder (set to Normal mode)

The incoming PHY-frame payload shall be divided into sequential blocks of information bits, K bits per block. Each block of information bits shall be encoded by the FEC, as described in §7.1.3.2. The valid values of K, the coded block size N_{FEC}, and the coding rate R, are presented in Table 7-19. The bits of each information block shall be in the same order as they are in the payload; the payload bit to be transmitted first shall be the first in the corresponding information block.

In normal mode of operation, PRE is disabled. The FEC codewords shall be passed directly to the output of the Payload Encoder and concatenated into the encoded payload block; their order shall be the same as the order of corresponding information blocks at the input of the Payload Encoder.

In case of RCM, each FEC codeword is further encoded by the PRE, as described in §7.1.3.3.1. The PRE-encoded FEC codewords are concatenated into the encoded payload block as defined in §7.1.3.3.1.

7.1.3.3.1 Payload repetition encoding

Payload Repetition Encoder (PRE) shall support the number of repetitions N_{REP} = 2, 3, 4 and 6. The used number of repetitions shall be advertised in the REP field in the PHY-frame header.

The PRE shall operate as follows. Each incoming FEC codeword shall be first copied N_{REP} times. Each copy shall be divided into S sections, numbered from 0 to S-1, with B bits in each section, as follows:

- Bits of the FEC codeword shall be mapped into sections in ascending sequential order; the bit of the FEC codeword to be transmitted first shall be the first bit (b_0) of Section 0;
- If after all bits of the FEC codeword are mapped, the last q bit positions of the last section remain empty, these position shall be filled by the first q bits of Section 0 in ascending sequential order.

Mapping of an FEC codeword onto sections is shown in Figure 7-8.

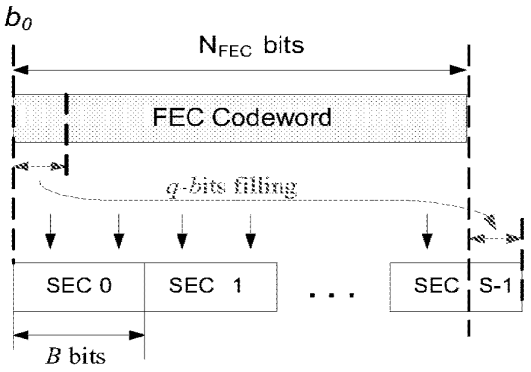


Figure 7-8/G.9960 – Mapping of a FEC codeword onto sections

The number of bits per section shall be $B = floor(k_P/N_{REP})$, where k_P is the total number of bits that can be loaded onto the payload OFDM symbol according to the current BAT. The number of sections per FEC codeword is: $S = ceiling(N_{FEC}/B)$.

If the computed value of S is 1, H consequent FEC codewords may be concatenated. The number of sections in this case shall be: $S = ceil(H \times N_{FEC}/B)$, where H is selected to provide $S > 1$ for the given values of N_{FEC}, N_{REP} and k_P. Concatenation of codewords may be applied only when the short FEC information block size is used. The total size of the concatenated codewords shall not exceed the maximum FEC codeword size.

If the number of FEC codewords in the payload is not a multiple of H, the necessary $z < H$ dummy FEC codewords shall be added. These dummy codewords shall be copies of the last FEC codeword of the same payload. The values of H (1, 2 and 4) and of z (0 to $H-1$) shall be indicated in the PHY-frame header.

The PRE shall output sections sequentially, in groups of S sections. Each group carries a copy of the FEC codeword. The number of groups per each FEC codeword is N_{REP}. The order of bits in each section shall be the same as these bits appear in the incoming FEC codeword.

The format of the encoded payload block with PRE enabled is presented in Figure 7-9. The total number of sections in the encoded payload block is $N_{REP} \times S$.

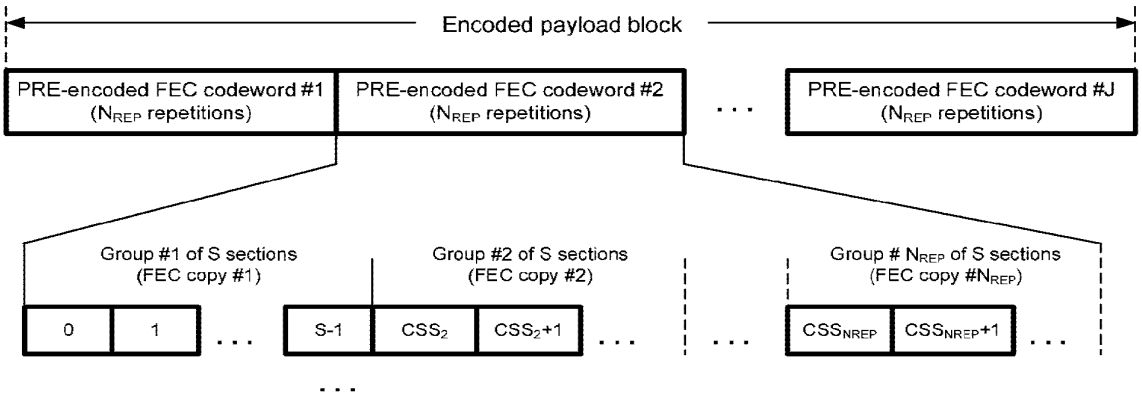


Figure 7-9/G.9960 – The format of the encoded payload block (payload consists of J FEC codewords)

The order of sections in the first group shall be ascending, from 0 to S-1; the order of sections in all subsequent groups shall be cyclically shifted. The shift is defined by the Cyclic Section Shift (CSS) vector {0 CSS_2 CSS_3 … CSS_{NREP}} with a length of N_{REP}, where CSS_L is the sequential number of the section to be transmitted first in the L-th group of sections. The value of CSS shall be computed using the following rule:

For N_{REP} = 2:

if (S mod 2) = 0 CSS:= {0,1};

else CSS:= {0,0};

For N_{REP} = 4:

if (S mod 4) = 0 CSS:= {0,1,2,3};

else if (S mod 2) = 0 CSS:= {0,0,1,1};

else CSS:= {0,0,0,0};

For N_{REP} = 3:

if (S mod 3) = 0 CSS:= {0,1,2};

else CSS:= {0,0,0};

For N_{REP} = 6:

if (S mod 6) = 0 CSS:= {0,1,2,3,4,5};

else if (S mod 3) = 0 CSS:= {0,0,1,1,2,2};

else if (S mod 2) = 0 CSS:= {0,0,0,1,1,1};

else CSS:= {0,0,0,0,0,0};

NOTE: As an example, with CSS = 3 for a group of S = 4 sections, these sections will be transmitted in the following order: 3, 0, 1, 2. The first group of sections, for comparison, is transmitted: 0, 1, 2, 3.

7.1.3.4 Header encoder

The functional model of the header encoder is presented in Figure 7-10. It contains an FEC encoder and a Header Repetition Encoder (HRE).

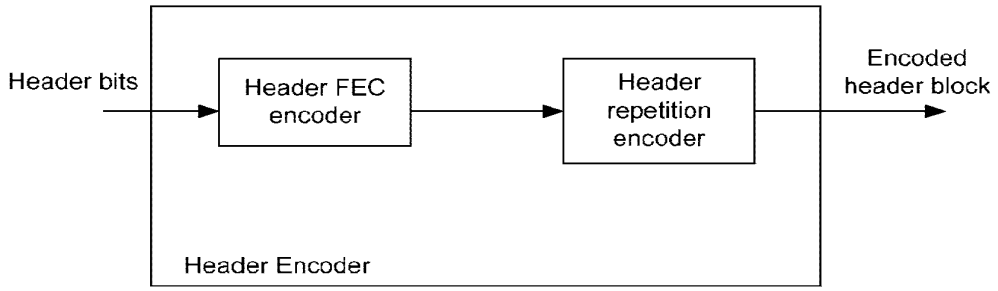


Figure 7-10/G.9960 – Functional diagram of the Header Encoder

The bits of the PHY-frame header shall input the Header FEC encoder in their original order and encoded as described in §7.1.3.2. The size of the FEC codeword and the coding rate of the Header FEC encoder are described in Table 7-19.

The FEC codeword enters the HRE. The HRE shall operate as follows:

- The FEC codeword shall be first copied M times, where M = ceiling ($D \times k_H / N_{FEC}$), k_H is the number of bits to be loaded onto the OFDM symbol carrying the header, and D is the number of symbols to be used for header transmission
- The encoded header block shall be formed by concatenation of M copies of the header FEC encoder output. As each codeword is cascaded to one another, the bits (b_i) within a codeword shall be cyclically shifted by 2 bits as follows:
  - The 1st FEC codeword copy shall be formed as $\{b_0, b_1, \ldots, b_{NFEC-2}, b_{NFEC-1}\}$.
  - The 2nd FEC codeword copy shall be formed as $\{b_2, b_3, \ldots, b_{NFEC-1}, b_0, b_1\}$.
  - The 3rd FEC codeword copy shall be formed as $\{b_4, b_5, \ldots, b_{NFEC-1}, b_0, b_1, b_2, b_3\}$.
  - …
  - The Mth FEC codeword copy, where M > 3, shall be formed as $\{b_{(2\times M-2)}, b_{(2\times M-1)}, \ldots, b_{NFEC-1}, b_0, b_1, \ldots, b_{(2\times M-4)}, b_{(2\times M-3)}\}$.

Valid values of D are either 1 or 2 (with D=1 being the default).

NOTE: Since the coding rate used for header encoding is ½, the number of bits in the FEC codeword is always even, and the number of bits in the encoded header block is even.

7.1.3.5 Segmentation into symbol frames

The encoded payload block from the output of Payload encoder and the encoded header block from the output of the Header encoder shall be segmented into symbol frames. The maximum number of bits in the symbol frame shall not exceed the values of k_P for payload symbol frames and k_H for

header symbol frame. Payload and header symbol frames shall be passed to the PMD, as described in Figure 7-4.

7.1.3.5.1 Payload segmentation

The encoded payload block shall be segmented into one or more symbol frames.

In normal mode, the first symbol frame shall contain the first k_P bits of the encoded payload block, the second frame shall contain the second k_P bits of the encoded payload block and so on, until the last symbol frame. If the remaining number of bits in the encoded payload is less than k_P, the last symbol frame shall remain incomplete. The unused sub-carriers of the OFDM symbol corresponding to the last symbol frame shall be modulated by a pseudo-random sequence of bits, as described in §7.1.4.2.6.

In RCM, the first symbol frame shall contain the first N_{REP} sections of the encoded payload block, the second frame shall contain the second N_{REP} sections of the encoded payload block, and so on, until the last symbol frame. If the number of bits in N_{REP} sections is less than k_P, symbol frames shall remain incomplete. The unused sub-carriers of the corresponding OFDM symbols shall be modulated by a pseudo-random sequence of bits, as described in §7.1.4.2.6.

7.1.3.5.2 Header segmentation

The encoded header block shall be segmented into D symbol frames ($D = 1$ or 2).

The first k_H bits of the encoded header block shall be mapped into the first symbol frame.

If $D = 1$, the rest of the bits of the encoded header block shall be discarded.

If $D = 2$, the second k_H bits shall be taken with an offset of half an FEC block, i.e., starting from the bit number $N_{FEC}/2$ of the encoded header block, and mapped into the second symbol frame. The rest of the bits in the encoded header block shall be discarded.

7.1.3.6 Probe frame

The Probe frame is intended for the channel assessment procedure. The header of the Probe frame shall be as defined in §7.1.2.3. The payload of the Probe frame (at the δ-reference point) shall contain a number of symbol frames with no data (all supported sub-carriers (SSCs) are inactive sub-carriers (ISCs)) as described in field PRBSYM in §7.1.2.3.2.6.1. The number of the symbols shall be indicated via the PRBSYM field in §7.1.2.3.2.6.1. The inactive sub-carriers of the corresponding OFDM symbols shall be modulated by a pseudo-random sequence of bits, as described in §7.1.4.2.6.

The number of symbol frames (and OFDM symbols) in the Probe frame is indicated in the PHY-frame header.

7.1.4 Physical medium dependent (PMD) sub-layer

The functional model of the PMD is presented in Figure 7-11. In the transmit direction, the Tone mapper divides the incoming symbol frames of the Header and Payload into groups of bits and associates each group of bits with a specific sub-carrier onto which this group shall be loaded, as specified in §7.1.4.2. The constellation encoder converts every group of the incoming bits into complex numbers which are, respectively, the real and imaginary part of the constellation point on which the particular group of bits is loaded for this subcarrier. The constellation mapping process is described in §7.1.4.3.1. The unused sub-carriers are modulated by a pseudo-random bit sequence generated as described in §7.1.4.2.6.

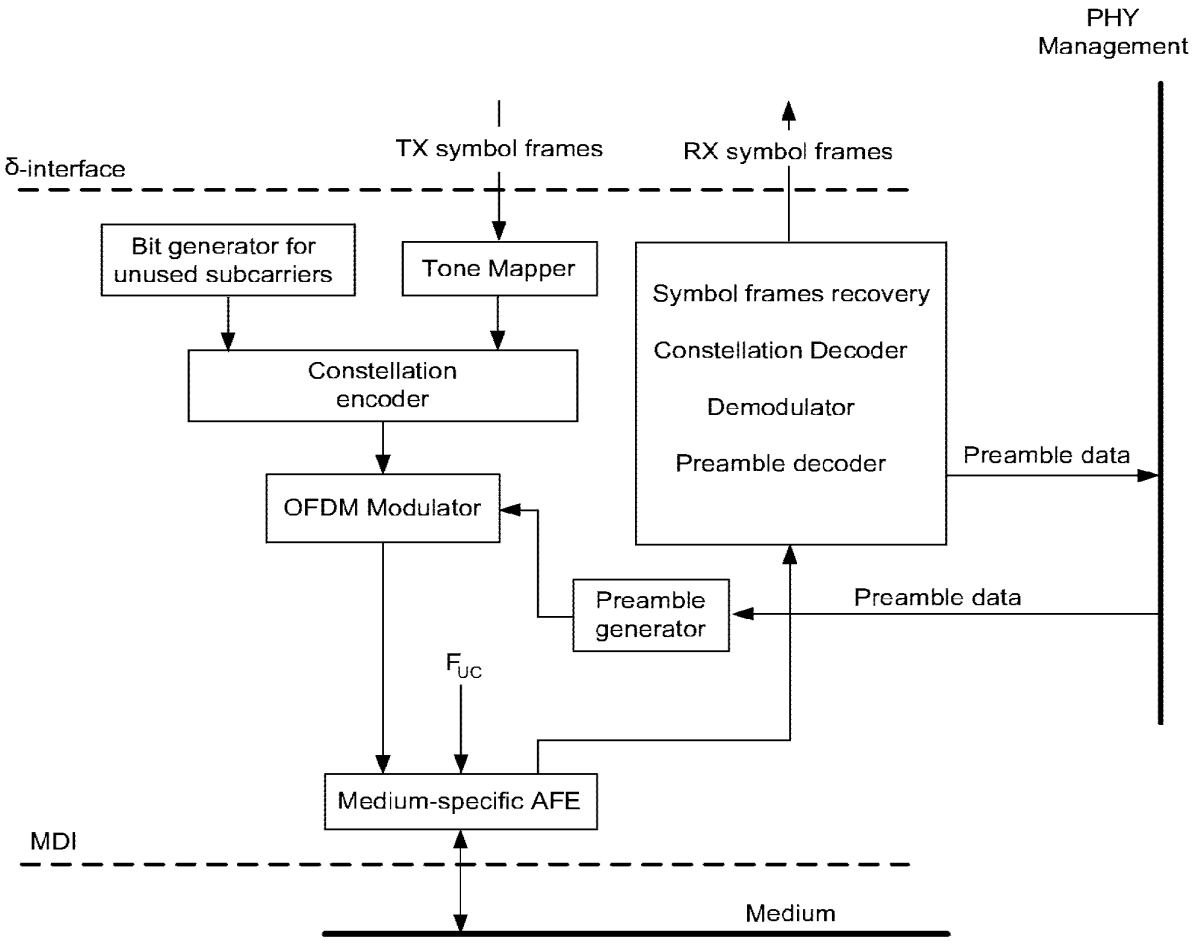


Figure 7-11/G.9960 – Functional model of the PMD

The OFDM modulator (§7.1.4.4) converts the stream of the N complex numbers at its input into the stream of N time-domain samples. After adding the Preamble, the transmit signal is up-shifted by the center frequency F_{US} or, for RF applications, by center frequency F_{UC} to fit the required spectrum of the transmit signal. Parameters of the Preamble (§7.1.4.5) are determined by the PHY management and depend on the type of the transmitted PHY frame.

Frames are output onto the medium with inter-frame gaps the details of which are for further study.

In the receive direction, the frames incoming from the medium are demodulated and decoded. The recovered symbol frames are transferred to the PMA via δ-interface. The preamble is processed and preamble data are passed to the PHY management entity.

7.1.4.1 Sub-carrier spacing and logical indexing

The sub-carrier spacing F_{SC} is the frequency spacing between any two adjacent sub-carriers. Valid values of sub-carrier spacing are presented in Table 7-28, with a tolerance of ±50 ppm.

The logical index is the index for loading data on sub-carriers. The logical index may be different from the input order to the IDFT used in §7.1.4.4.1. The order in which constellation points

associated with particular sub-carriers are input to the IDFT shall be in accordance with the following indexing rules.

The logical index of sub-carriers shall be from $i = 0$ to $i = N - 1$ using one of the following two rules:

Rule #1: The sub-carriers with all logical indices from $i = 0$ to $i = N - 1$ shall be centered at frequencies $f = F_{US} - (N/2 - i) \times F_{SC}$.

Rule #2: The sub-carriers with even logical indices from $i = 0$ to $i = N - 2$ shall be centered at frequencies $f = F_{UC} + F_{US} + (i/2) \times F_{SC}$ while those with odd logical indices from $i = 1$ to $i = N - 1$ shall be centered at frequencies $f = F_{UC} + F_{US} - ((i+1)/2) \times F_{SC}$.

Logical indexing rules shall be applied in accordance with the Domain Type and the bandplan, as specified in Table 7-30, Table 7-33, and Table 7-37.

Not all sub-carriers may always be used for data transmission; some of them have to be switched off in special circumstances. Others may be only used with reduced power. The latter functions are performed by tone masking and gain scaling (§7.1.5.1, 7.1.5.3).

NOTE – The particular sub-carriers used for data transmission between two particular nodes depend on channel characteristics, such as loop attenuation and noise, and on the specific spectrum-use requirements, such as notching of amateur radio bands; some sub-carriers may be subject for PSD reduction, e.g., at high and low frequencies to share the medium with other services.

NOTE – In case of a non-RF application, the value of F_{UC} is zero. For baseband applications (the lowest sub-carrier frequency is zero), the value of F_{US} should be: $F_{US} = F_{SC} \times N/2$.

7.1.4.2 Tone Mapper

The tone mapper determines the number of bits to be loaded on each sub-carrier and the value of gain on each sub-carrier. The ability of bit loading depends on the type of the sub-carrier.

7.1.4.2.1 Summary of sub-carrier types

For the purpose of tone mapping, the following types of sub-carriers are defined.

1. Masked sub-carriers (MSC) are those on which transmission is not allowed, i.e., the gain on this sub-carrier shall be set to zero. Two types of MSC are defined:

- Permanently masked sub-carriers (PMSC) – those that are never allowed for transmission. The list of PMSC, also called PMSC mask, depends on the media type and is defined by limited PSD mask, §7.2. Data bits are never mapped on PMSC.

- Regionally masked sub-carriers (RMSC) – those that are not allowed for data transmission in some regions, while may be allowed in other regions. The list of RMSC forms a RMSC mask, which depends on the type of media and on the region/application. The number of RMSC, #RMSC = #MSC - #PMSC.

2. Supported sub-carriers (SSC) are those on which transmission is allowed under restrictions of the relevant PSD mask. The number of SSC, #SSC = N – #MSC. The following types of SSC are defined:

- Active sub-carriers (ASC) – those that have loaded bits ($b \geq 1$) for data transmission. ASC are subject to constellation point mapping, constellation scaling and constellation scrambling as described in §7.1.4.3. Data bits shall be mapped on ASC as described in §7.1.4.2.2.

- Inactive sub-carriers (ISC) – those that don't have any data bits loaded (e.g., because SNR is low, or by any other reason). The number of ISC, #ISC = #SSC – #ASC. ISC can be used for measurement purposes or other auxiliary purposes. ISC are subject for transmit power shaping. The signals transmitted on ISC are defined in §7.1.4.2.6.

All sub-carriers with frequencies between the supported sub-carrier with the lowest frequency and the supported sub-carrier with the highest frequency are also called "in-band sub-carriers".

7.1.4.2.2 Bit Allocation Tables (BAT)

Tone mapping is defined by a Bit Allocation Table (BAT) that associates sub-carrier indexes with the number of bits to be loaded on the sub-carrier. The order of sub-carrier indexes in BAT shall be numerical, from the smallest index to the largest index. Bits of the TX symbol frame shall be loaded on the sub-carriers in the order of indexes in BAT, according to subcarrier indexing defined in §7.1.4.1.

The BATs used by the node in the particular PHY frame shall be indicated to the receiving node(s) in the TPN field of the PHY-frame header, as described in §7.1.2.3, using a BAT identifier (BAT_ID). Up to 32 BAT with BAT_ID values in the range from 0 to 31 can be defined. One or more BAT_ID can be assigned for each destination (per unicast or multicast DID). The assignment of BAT_ID shall be as described in Table 7-20.

Table 7-20/G.9960 – Assignment of BAT_ID

BAT_ID	Type of BAT	Reference
0	Pre-defined, Type 0	§7.1.4.2.2.1
1	Pre-defined, Type 1	
2	Pre-defined, Type 2	
3	Pre-defined, Type 3	
4-15	Reserved for pre-defined BATs	
16-31	Reserved for runtime BATs	§7.1.4.2.2.2

Every node shall support at least pre-defined BATs of Type 0 and Type 1. Support of other BATs is profile-dependent and shall be as described in Table 7-26.

7.1.4.2.2.1 Pre-defined BATs

The following pre-defined BATs are defined.

1. Pre-defined BAT Type 0: Uniform 2-bit loading on all sub-carriers except the PMSC set.
2. Pre-defined BAT Type 1: Uniform 1-bit loading on all sub-carriers except the PMSC set.
3. Pre-defined BAT Type 2: Uniform 2-bit loading on a particular selected ASC set.
4. Pre-defined BAT Type 3: Uniform 1-bit loading on a particular selected ASC set.

NOTE: Pre-defined BAT Type 0 and Type 1 may be used when channel characteristics are unknown (i.e., no knowledge is available on whether particular tones could be loaded bits or not).

NOTE: Pre-defined BATs that are implemented using a particular ASC set (e.g., Type 2) are always associated with a reference, such as a runtime BAT, which defines this ASC set. The coding is for further study.

7.1.4.2.2.2 Runtime BATs

A runtime BAT associates indices of SSCs with the number of bits to be loaded on each sub-carrier. The subset of indices in the BAT with the number of loaded bits $b > 0$ identifies the ASC. Runtime BAT can be defined by the receiving node (receiver-defined BAT) or selected by the transmitting node (transmitter-determined BAT) for a specific unicast or multicast channel. Runtime BATs shall be communicated from the node which generates the BAT to the peer (e.g., a node sourcing multicast transmission to several other nodes will communicate the BAT to all receiving nodes prior to sending data).

The number of bits loaded on any sub-carrier shall not exceed the maximum number of bits allowed (see §7.1.4.3). The number of bits shall also meet the bit loading capabilities of the communicating nodes, as advertised by them prior to communication.

7.1.4.2.3 Transmitter-determined and receiver-determined mapping

Two types of tone mapping are defined: transmitter-determined and receiver-determined. With transmitter-determined mapping, the BAT is defined by the transmitter and shall be either a pre-defined BAT or it shall be communicated to all destination nodes prior to transmission. With receiver-determined mapping, the BAT is defined by the receiver of the destination node and communicated back to the transmitter.

For unicast transmission, the node shall use either one of the pre-defined BATs (transmitter-determined) or a BAT defined by the receiver of the destination node for the PHY frame. For multicast transmission both pre-defined BATs (transmitter determined) and runtime BATs can be used. If a runtime BAT is used, it shall be defined by the node sourcing the multi-cast (transmitter-determined); this node shall generate the BAT and communicate it to all multi-cast destinations.

The BAT communication protocol is for further study.

A node shall support both transmitter-determined and receiver-determined types of mapping, with the minimum number of simultaneously supported BAT depends on the profile. The definition of profiles is for further study.

7.1.4.2.4 BAT with sub-carrier grouping

A node shall be capable to define any runtime BAT using sub-carrier grouping of $G = 1$ (no grouping), 2, 4, 8, and 16 sub-carriers with subsequent frequencies. The default value of $G = 1$. If grouping is used ($G > 1$), all sub-carriers of the same group shall use the same bit loading. The first group shall include G sub-carriers in ascending order of subcarrier indexes defined in §7.1.4.1. If a group includes sub-carriers that are masked (e.g., MSC) or extends beyond the applicable sub-carrier set, the node shall apply the bit loading assigned for this group only to the applicable sub-carrier set.

The group index G shall be indicated when the BAT is communicated, details of which are for further study.

7.1.4.2.5 Special mappings

7.1.4.2.5.1 Tone mapping for PHY-frame header

The PHY-frame header shall use a uniform loading of 2 bits per sub-carrier on all sub-carriers except the PMSC set.

7.1.4.2.5.2 Tone mapping for RCM

Payload transmission in robust communication mode RCM shall use pre-defined BAT Type 0.

7.1.4.2.5.3 Tone mapping for probe frame

The payload of the Probe frame shall be modulated using a uniform loading of 1 bit per sub-carrier on all SSC set. For Probe frames, ISC = SSC.

7.1.4.2.6 Modulation of unloaded sub-carriers

Supported sub-carriers (SSC) that are not loaded with payload bits or that are partially loaded with payload bits shall be loaded with a pseudo-random sequence defined by the Linear Feedback Shift Register (LFSR) generator with the polynomial $p(x)=x^{23}+x^{18}+1$ shown in Figure 7-12. The LFSR generator shall be initialized to all ones (0x7FFFFF) at the beginning of the first payload OFDM Symbol. It shall be advanced by two bits for each sub-carrier (for both SSC and MSC).

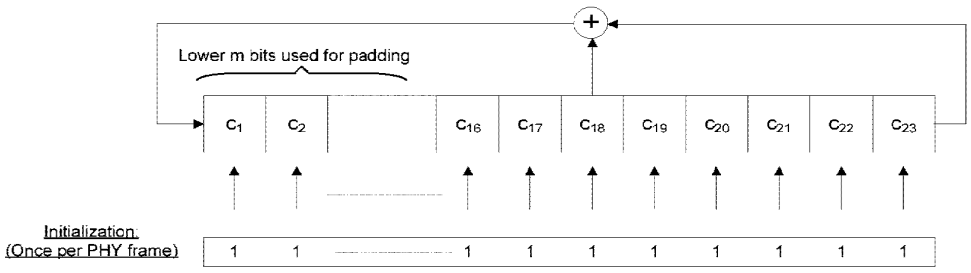


Figure 7-12/G.9960 – LFSR for modulation of unloaded and partially loaded sub-carriers

The modulation of sub-carriers that are not loaded with payload bits shall be as follows:

1) Starting at the beginning of the first payload OFDM symbol, each sub-carrier from the ISC set shall be modulated with the two bits which are the LSBs of the LFSR, c_1, and c_2 using 2-bits constellation mapping defined in §7.1.4.3.1.1 (c_1 is transmitted first). If a special channel-estimation symbol is used after the PHY-header, it shall be considered as a payload symbol for this purpose. All SSC of a channel-estimation symbol are ISC.
2) In every OFDM symbol of payload, if the number of bits in the symbol frame doesn't fill the entire symbol, the bits from the LFSR shall be used to fill the remainder of the symbol frame, by taking the sequential groups of *m* LSBs of the LFSR and mapping them onto the remaining sub-carriers so that LSB of LFSR is transmitted first and in the order defined by the current BAT, where *m* is the number of bits allocated for that sub-carrier by the BAT. For the first padded sub-carrier, if n bits of the m loaded bits are data bits, these n data bits shall be loaded as the LSBs of the group of bits mapped on the constellation point, and the *m-n* bits of the LFSR shall be used as the MSBs of the group of bits mapped on the constellation point starting from LSB of LFSR.

3) In the case of a Probe frame, starting at the beginning of the first payload OFDM symbol, each sub-carrier from the ISC set shall be modulated with the one bit, which is the LSB of the LFSR, c_1, using 1-bit constellation mapping defined in §7.1.4.3.1.2.

7.1.4.3 Constellation Encoder

7.1.4.3.1 Constellation mapping

Constellation mapping associates every group of bits loaded onto a sub-carrier, with the values of I (in-phase component) and Q (quadrature component) of a constellation diagram. Each incoming group of b bits $\{d_{b-1}, d_{b-2}, \ldots d_0\}$ shall be associated with a specific values of I and Q computed as described in this section.

Each group of bits $\{d_{b-1}, d_{b-2}, \ldots d_0\}$ shall be mapped onto the constellation mapper with the LSB bit, d_0, first.

7.1.4.3.1.1 Constellations for even number of bits

If the number of bits, b, loaded onto the sub-carrier is even (2, 4, 6, 8, 10, 12), square-shaped constellations with mappings described in this section shall be used. Support of all the specified even order constellations (2, 4, 6, 8, 10 and 12) shall be mandatory at both the transmitter and the receiver. With square-shaped constellations 2^b constellation points are set as a square, and 2^{b-2} points reside in each quadrant with odd values (positive or negative) of I and Q.

Constellation and mapping for $b = 2$ shall be as presented in Figure 7-13 and described in Table 7-21.

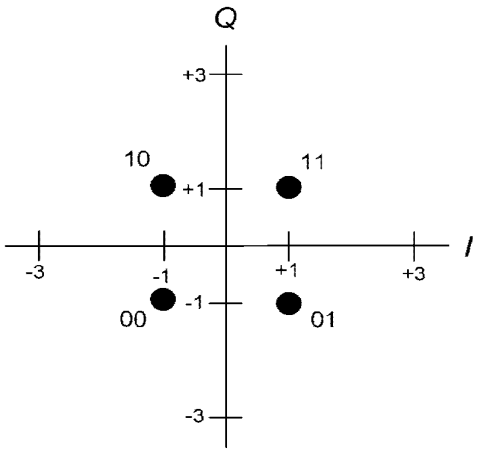


Figure 7-13/G.9960 - Constellation and mapping for $b = 2$

Table 7-21/G.9960 - Mapping for $b = 2$ (QPSK)

Bit d_0	I		Bit d_1	Q
0	-1		0	-1
1	1		1	1

Constellation mapping for $b = 4$ shall be as described in Table 7-22. The first quadrant of the mapping is presented in Figure 7-14.

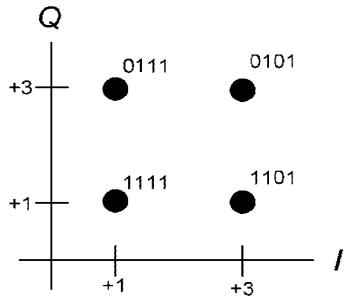


Figure 7-14/G.9960 – Constellation and mapping for $b = 4$ (first quadrant)

Table 7-22/G.9960 - Mapping for $b = 4$

Bits $[d_1 d_0]$	I		Bit $[d_3 d_2]$	Q
00	-3		00	-3
10	-1		10	-1
11	1		11	1
01	3		01	3

Constellation mappings for even values of $b \geq 4$ shall be derived by the following steps.

1. Divide the incoming group of b bits into two equal sub-groups, so that $b/2$ LSBs form the first sub-group (I-group) and $b/2$ MSBs form the second sub-group (Q-group); both sub-groups are incoming LSB (which are d_0 and $d_{b/2}$, respectively) first.

2. Compute values of I and Q for the incoming group $\{d_{b-1}, d_{b-2}, \ldots d_0\}$ as:

$I = sgn_I \times val_I$

$Q = sgn_Q \times val_Q$

The values of *sgn* and *val* shall be computed as presented in Table 7-23 using bits of I-group to compute I and bits of Q-group to compute Q.

Table 7-23/G.9960 – Computation rule for *sgn* and *val*

I - component	*Q* - component
- compute $sgn_I = 2 \times d_0 - 1$ - compute $val_I = \lvert I_{b-2} - 2^{b/2-1} \rvert$	- compute $sgn_Q = 2 \times d_{b/2} - 1$ - compute $val_Q = \lvert Q_{b-2} - 2^{b/2-1} \rvert$
NOTES: 1. I_{b-2} and Q_{b-2} are the values of I and Q computed for the incoming (b-2)-bit group $\{d_{b-1}, d_{b-2}, \ldots d_{b/2+1}, d_{b/2-1}, \ldots d_1\}$, i.e., with removed d_0 and $d_{b/2}$. 2. The values of I and Q for 2-bit groups shall be as presented in Table 7-21 3. |X| is the absolute value of X	

7.1.4.3.1.2 Constellations for odd number of bits

If the number of bits, b, loaded onto the sub-carrier is odd (1, 3, 5, 7, 9, 11), constellations with mappings described in this section shall be used. The support of all the specified odd order constellations (1, 3, 5, 7, 9 and 11) shall be mandatory at the transmitter. The support of all the specified odd order constellations with $b \geq 5$, shall be optional at the receiver.

For multi-cast transmission, odd constellations with $b \geq 5$ shall not be used.

Constellation and mapping for $b = 1$ shall be as presented in Figure 7-15.

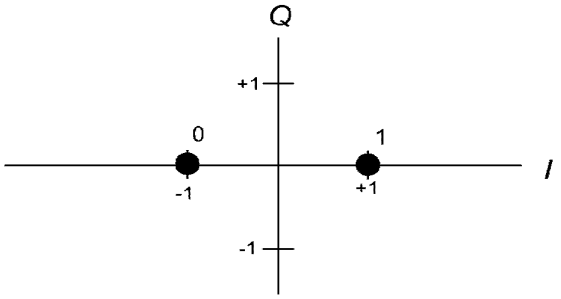


Figure 7-15/G.9960 - Constellation shape and mapping for $b = 1$

Constellation and mapping for $b = 3$ shall be as presented in Figure 7-16.

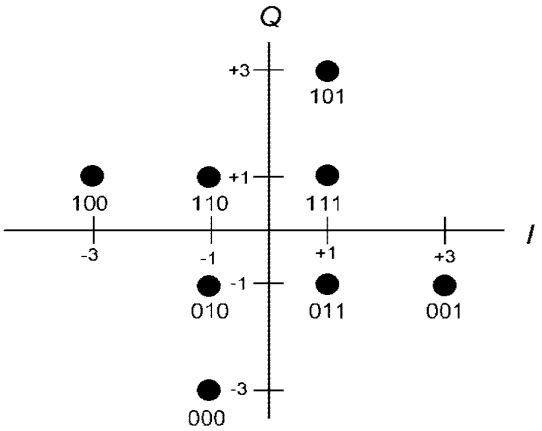


Figure 7-16/G.9960 - Constellation and mapping for $b = 3$

For $b > 3$ cross-shaped constellations shall be used. First, 2^b constellation points shall be set as a rectangle, with $M_I = 2^{B1}$ columns (M_I points on the I-axis) and $M_Q = 2^{B2}$ rows (M_Q points on the Q-axis), where B1 = *ceiling*(b/2) and B2 = *floor*(b/2). The mapping of these points shall be computed using the following steps.

1. Divide the incoming group of bits into two sub-groups, so that B1 LSBs form the first sub-group (I-group) and B2 MSBs form the second sub-group (Q-group); both sub-groups are incoming LSB (which are d_0 and d_{B2+1}, respectively) first.

2. Compute values of I and Q of a rectangular constellation for the incoming group $\{d_{b-1}, d_{b-2}, \ldots d_0\}$ as:

$I = sgn_I \times val_I$

$Q = sgn_Q \times val_Q$

The values of *sgn* and *val* shall be computed as presented in Table 7-24 using bits of I-group to compute I and bits of Q-group to compute Q.

Table 7-24/G.9960 – Computation rule for *sgn* and *val*

I - component	Q - component
- compute $sgn_I = 2 \times d_0 - 1$ - compute $val_I = \lvert I_{2 \times B1} \rvert$	- compute $sgn_Q = 2 \times d_{B1} - 1$ - compute $val_Q = \lvert Q_{2 \times B2} \rvert$
NOTES: 1. $I_{2 \times B1}$ is the value of I for (2×B1)-bit group $\{0\ d_{b-1}, d_{b-2}, \ldots d_0\}$ computed as defirned in Table 7-23. 2. $Q_{2 \times B2}$ is the value of Q for (2×B2)-bit group $\{d_{b-1}, d_{b-2}, \ldots d_1\}$ computed as defirned in Table 7-23. 3. |X| is the absolute value of X	

3. Transform $s = (M_I - M_Q)/4$ columns of constellation points in each quadrant having highest absolute values of I (positive or negative) into rows of Q by changing their $\{I, Q\}$ coordinates to $\{I', Q'\}$ in the following way:

- $|Q'| = |I| - 2s$, and $\text{sign}(Q') = \text{sign}(I)$;
- $|I'| = M_Q - |Q|$, and $\text{sign}(I') = \text{sign}(Q)$.

The described transformation of $\{I, Q\}$ coordinates for $b = 7$ is presented in Figure 7-17 with B1 = 4 and B2 = 3 (the MSB and LSB in Figure 7-17 are separated by "/").

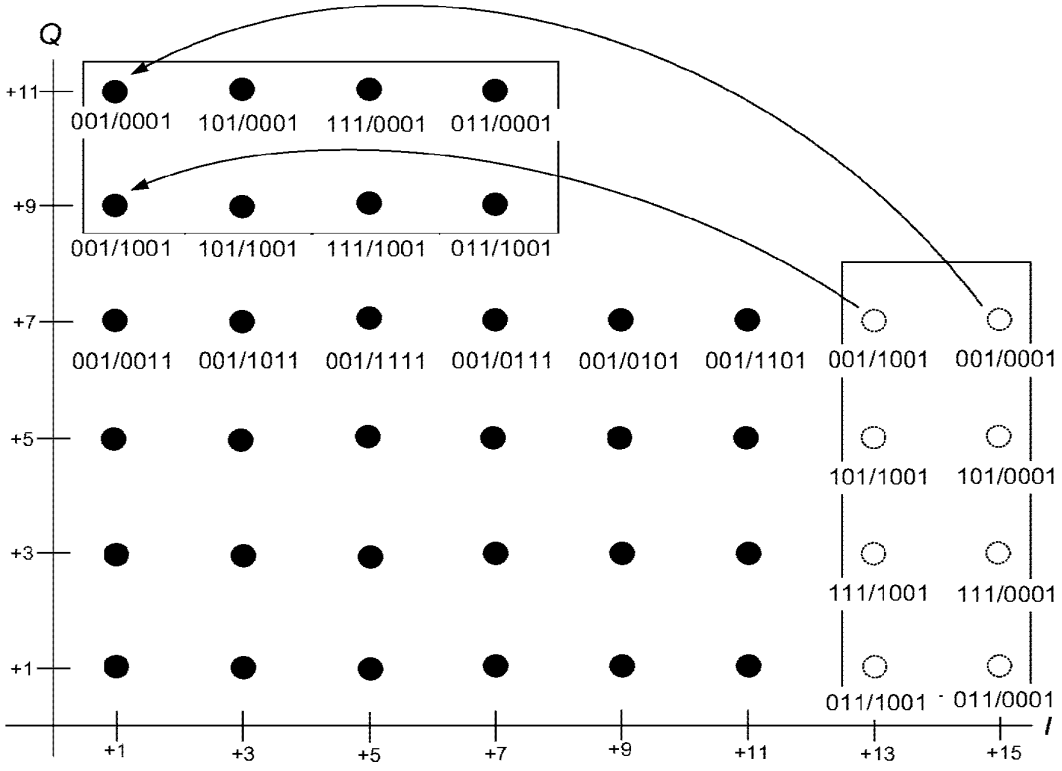


Figure 7-17/G.9960 - Transformation of rectangular constellation into cross-shaped constellation for $b = 7$ (first quadrant)

7.1.4.3.2 Constellation point scaling

Each constellation point (I, Q), corresponding to the complex value $I + jQ$ at the output of the constellation mapper, shall be scaled by the power-normalization factor $\chi(b)$, the frequency-domain spectrum shaping coefficient tss, and the gain adjuster g:

$$Z = \chi(b) \times tss \times g \times (I + jQ).$$

7.1.4.3.2.1 Power normalization factor

The values (*I, Q*) for each constellation point of each sub-carrier shall be scaled such that all constellations, regardless of their size, have the same average power. The required scaling, $\chi(b)$, for a sub-carrier with *b*-bit loading depends only on the value of *b* and shall be set as presented in Table 7-25.

Table 7-25/G.9960 – Power normalization factor

Number of bits loaded (*b*)	Scaling factor (χ) (linear scale)
1	1
2	$1/\sqrt{2}$
3	$1/\sqrt{6}$
4	$1/\sqrt{10}$
5	$1/\sqrt{20}$
6	$1/\sqrt{42}$
7	$1/\sqrt{82}$
8	$1/\sqrt{170}$
9	$1/\sqrt{330}$
10	$1/\sqrt{682}$
11	$1/\sqrt{1322}$
12	$1/\sqrt{2730}$

7.1.4.3.2.2 Transmit spectrum shaping

Frequency-domain spectrum shaping of the transmit signal is achieved by a scaling factor *tss* defined for each sub-carrier. The *tss* values are set by the transmitter and shall be in the range between 0 and 1 (linear) in steps of 1/1024. The *tss* values shall be set such that the highest value across all sub-carriers is 1. Smaller values of *tss* provide attenuation and the value $tss = 0$ corresponds to no power transmitted on the particular sub-carrier. If no spectrum shaping is applied, the *tss* values shall be equal to 1 for all sub-carriers. The values of tss_i are relevant only for sub-carriers that are actually transmitted (not masked), and shall be ignored for masked sub-carriers (see §7.1.5.3).

The communication protocol for *tss* is for further study.

7.1.4.3.2.3 Gain adjustment

The gain adjuster *g* is intended for fine gain adjustment of the power transmitted at a particular sub-carrier, which may be used to equalize the SNR margin over all sub-carriers.

The value of gain adjuster shall be set to 1. Other values are left for further study.

7.1.4.3.3 Constellation Scrambler

The phase of constellation points generated by the Constellation Mapper shall be shifted in accordance with the pseudo-random sequence generated by a Linear Feedback Shift Register (LFSR) generator, as shown in Figure 7-18.

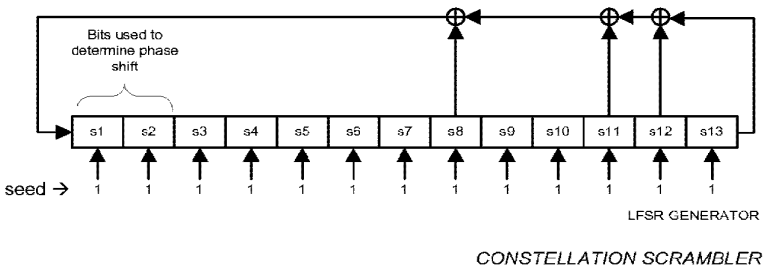


Figure 7-18/G.9960 – Constellation scrambler

The LFSR generator shall implement the polynomial $g(x) = x^{13} + x^{12} + x^{11} + x^8 + 1$ and shall be advanced by 2 bits for each sub-carrier. The two LSB's of the register shall be taken to determine the phase shift as shown in Table 7-26. The shift of the LFSR for subcarrier index k will be 2k.

Table 7-26/G.9960 – Constellation phase shift versus LSFR output

LFSR OUTPUT		PHASE SHIFT (rad)
S2	S1	
0	0	0
0	1	$\pi/2$
1	0	π
1	1	$3\pi/2$

The LFSR generator shall be initialized with the seed 0x1FFF for each OFDM symbol. The constellation scrambling shall be applied to the PHY-frame header and all payload symbols.

7.1.4.4 OFDM modulator

The OFDM modulator consists of the following major parts: IDFT, cyclic extension, windowing, overlap and add, and frequency up-shift. The incoming signal to the modulator at the *l*-th OFDM symbol in the present frame for a single sub-carrier, with index *i,* is the real and imaginary parts of the value $Z_{i,l}$ generated by the Constellation encoder as described in §7.1.4.3.2 (for symbols of the header and the payload) or by Preamble Generator as described in §7.1.4.5.2.1 (for symbols of the preamble). Time-domain samples generated by the IDFT, after adding the cyclic prefix and windowing, are frequency up-shifted to the center frequency F_{US}. The functional diagram of

OFDM modulator is presented in Figure 7-19. RF up-converter facilitates G.9960 operation in RF frequency range.

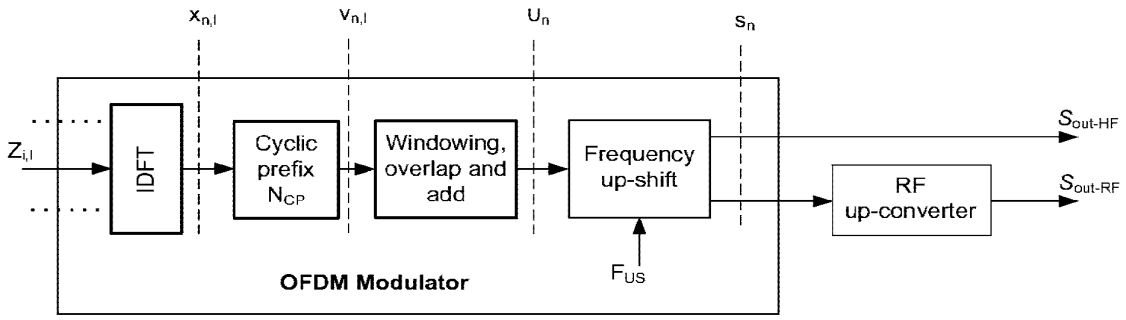


Figure 7-19/G.9960 – Functional model of the OFDM modulator

The presented functional diagram and other figures presented in this section do not imply any specific implementation. All aspects of signal processing used in the modulator shall comply with equations and textual descriptions.

7.1.4.4.1 IDFT

The IDFT converts the streams of the N complex numbers $Z_{i,l}$ at its inputs into the stream of N complex time-domain samples $x_{n,l}$. The input numbers represent the N mapped blocks of data, where i-th block of data represents the relative complex value $Z_{i,l} = \mathrm{Re}(Z_{i,l}) + j\mathrm{Im}(Z_{i,l})$ of the i-th modulated sub-carrier of the OFDM signal, where $i = 0, 1, \ldots N\text{-}1$ is the sub-carrier index and l is the sequential number of the OFDM symbol within the current frame, excluding the preamble. The conversion shall be performed in accordance with the equation:

$$x_{n,l} = \sum_{i=0}^{N-1} \exp\left(j \cdot 2\pi \cdot i \frac{n}{N} \right) \cdot Z_{i,l} \qquad \text{for } n = 0 \text{ to } N-1, \quad l = 0 \text{ to } M_F - 1 .$$

where M_F denotes the total number of OFDM symbols in the current frame and the value of N represents the maximum number of possibly modulated sub-carriers in the OFDM spectrum and shall be a power of 2: $N = 2^k$, where k shall be an integer. The value of $Z_{i,l}$ for all masked sub-carriers shall be set to 0. If some non-masked sub-carriers with indexes $i < N$ are not modulated (not in use), the corresponding values of $Z_{i,l}$ shall be generated as described in §7.1.4.2.6

7.1.4.4.2 Cyclic extension and OFDM symbol

The cyclic extension provides guard interval between data-carrying samples of adjacent OFDM symbols. This guard interval is necessary to protect the data-carrying samples from the inter-symbol interference (ISI) caused by the previous symbol.

In OFDM guard interval of the l-th OFDM symbol in the frame shall be implemented by pre-pending the last $N_{CP}(l)$ samples of the IDFT (called cyclic prefix) to its output N samples, as presented in Figure 7-20. The order of samples in the symbol shall be as follows:

- The first sample of the symbol is the IDFT output sample N-$N_{CP}(l)$;
- The last sample of $N_{CP}(l)$ is the IDFT output sample N-1; next sample is the IDFT output sample 0.

The l-th OFDM symbol consists of N IDFT samples and $N_{CP}(l)$ cyclic extension, samples, in total:

$$N_W(l) = N + N_{CP}(l) \text{ [samples]}.$$

After cyclic extension as described above, time domain samples at the reference point $v_{n,1}$ in Figure 7.19 shall comply with the following equations:

$$v_{n,l} = x_{n-N_{CP}(l),l} = \sum_{i=0}^{N-1} Z_{i,l} \times \exp\left(j \cdot 2\pi \cdot i \frac{n - N_{CP}(l)}{N} \right) \cdot \quad \text{for } n = 0 \text{ to } N_W(l) - 1 = N + N_{CP}(l) - 1$$

The number of IDFT samples, N, and the number of windowed samples, β, shall be the same for all symbols of the same frame. The value of $N_{CP}(l)$ (and the duration of the symbol $N_w(l)$, accordingly) may change during the course of the frame, as following:

- All symbols of the header shall have the value of $N_{GI\text{-}HD}+\beta$ defined in §7.1.4.6;
- The first two symbols of the payload shall have the default value $N_{GI\text{-}DF}+\beta$, defined in §7.1.4.6. If a special channel-estimation symbol is used after the PHY-header, it shall be considered as a payload symbol for this purpose;
- All the rest of the payload symbols shall have the same value of N_{GI} selected from the valid values defined in §7.1.4.6 and indicated in the header, as described in §7.1.2.1.

7.1.4.4.3 Symbol Timing

The PHY frame consists of a preamble followed by an integer number, M_F, of symbols. The first symbol following the preamble (the first symbol of the PHY-header) shall have symbol count 0, and the last symbol of the frame shall have symbol count M_F-1. The time position of each symbol in the frame is defined by sample count. The first sample of the symbol with symbol count 0 shall have sample count $M(0)=N_{pr}-\beta$, where N_{pr} is the number of samples in the preamble. The count of the first sample of the l-th symbol (l = 1, 2, … M_F-1) in the frame shall be:

$$M(l) = N_{pr} - \beta + \sum_{k=0}^{l-1} N_S(k),$$

where $N_S(k) = N + N_{CP}(k) - \beta$ and $N_S(k)$ may be different for symbols of the header and payload, as described in §7.1.4.6.

7.1.4.4.4 Windowing, overlap and add

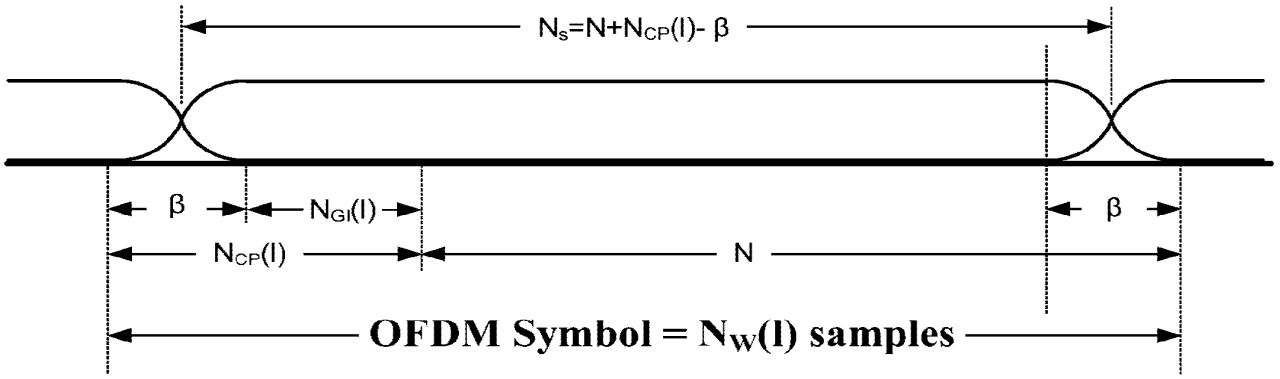


Figure 7-20/G.9960 – Structure of an OFDM symbol with cyclic extension and overlapped windowing

The first β samples of the cyclic prefix and last β samples of the IDFT output shall be used for shaping the envelope of the transmitted signal (windowing). The window function facilitates PSD shaping: it allows sharp PSD roll-offs used to create deep spectral notches and reduction of the out-of-band PSD. The number of windowed samples, β, shall be the same for all of the payload symbols of the same frame, as well as the PHY-header and preamble.

To reduce the modulation overhead, the windowed samples of adjacent symbols shall overlap, as presented in Figure 7-20. The value of $N_{CP}(l)$ - $\beta = N_{GI}(l)$ forms the guard interval. The duration of the *l-th* OFDM symbol is thus $N_S(l) = N + N_{CP}(l) - \beta$.

After windowing, overlap and add, time domain samples at the reference point u_n in Figure 7.19 shall comply with the following equations:

$$u_n = u_n^{(pr)} + \sum_{l=0}^{M_F-1} w(n - M(l), l) \times \upsilon_{n-M(l),l} \qquad \text{for } n = 0 \text{ to } M(M_F - 1) + N_W(M_F - 1) - 1,$$

where $u_n^{(pr)}$ is the n'th sample of the preamble, as defined in §7.1.4.5 (Note: the signal $u_n^{(pr)}$ already includes windowing as necessary), $w(n,l)$ is the windowing function defined on $N_W(l)$ samples of the OFDM symbol in the following way:

$$w(n,l) = \begin{cases} w_\beta(n) & 0 \le n < \beta \\ 1 & \beta \le n < N_W(l) - \beta \\ w_\beta(N_W(l) - 1 - n) & N_W(l) - \beta \le n < N_W(l) \\ 0 & \text{otherwise} \end{cases},$$

where $w_\beta(n)$ is the function describing the roll-off section of the window. The roll-off function $w_\beta(n)$ shall be vendor discretionary.

However, $w_\beta(n)$ shall comply with the following rules:

- $w_\beta(n) + w_\beta(\beta - n) = 1$ for $0 \le n < \beta$.
- $0 \le w_\beta(n) \le 1$.

The symbol rate f_{OFDM} (number of symbols per second) and symbol period T_{OFDM} for the given value of N_{CP} and β shall be computed, respectively:

$$f_{OFDM} = \frac{N \times F_{SC}}{N + N_{CP} - \beta},$$

and $T_{OFDM} = 1/f_{OFDM}$.

7.1.4.4.5 Frequency up-shift

The frequency up-shift offsets the spectrum of the transmit signal setting it around the frequency F_{US}. The value of F_{US} shall be a multiple of the sub-carrier frequency F_{SC}:

$F_{US} = m*F_{SC}$, where m is an integer and $N/2 \leq m$.

The valid values of m are specified in §7.1.4.6.

The real and imaginary components of the signal after frequency up-shift (reference point s_n in Figure 7-19) shall be as follows:

$$s_n = u_{n/p} \times \exp\left(j\frac{2\pi mn}{Np}\right) = \mathrm{Re}(s_n) + j\,\mathrm{Im}(s_n) \qquad \text{for } n = 0 \text{ to } \left[M(M_F - 1) + N_W(M_F - 1)\right] \times p - 1;$$

$$\mathrm{Re}(s_n) = \mathrm{Re}(u_{n/p})\cos\left(\frac{2\pi mn}{Np}\right) - \mathrm{Im}(u_{n/p})\sin\left(\frac{2\pi mn}{Np}\right)$$

$$\mathrm{Im}(s_n) = \mathrm{Re}(u_{n/p})\sin\left(\frac{2\pi mn}{Np}\right) + \mathrm{Im}(u_{n/p})\cos\left(\frac{2\pi mn}{Np}\right)$$

where $u_{n/p}$ is u_n after interpolation with factor p. The interpolation factor p is vendor discretionary, and shall be equal to or higher than 2.

NOTE: The minimum value of p sufficient to avoid distortions depends on the ratio between the center frequency F_{US} and the bandwidth of the transmit signal $BW = N*F_{SC}$. It is assumed that an appropriate low-pass filter is included to reduce imaging.

NOTE: The phase of the up-shift should be initialized to zero at the first sample of the Preamble and be advanced by $\frac{2\pi m}{Np}$ per each sample (after interpolation).

NOTE: For certain values of N_{GI}, β, and m, the phase of the up-shifter at the first sample of some symbols may not be zero. In these cases a $2N$-point real-valued IFFT implementation has to compensate by adjusting phases appropriately in order to match the modulation described here.

7.1.4.4.6 Output signal

For all applications which don't use RF up-converter (further referred to as HF-applications), the output signal of the modulator shall be the real component of s_n:

$S_{out\text{-}HF} = \mathrm{Re}(s_n)$.

For RF applications, the RF up-converter shall produce the following output signal:

$$S_{out-RF}(t) = \mathrm{Re}\left[s(t) \times \exp(j2\pi F_{UC}t)\right] = \mathrm{Re}\left[s(t)\right] \times \cos(2\pi F_{UC}t) - \mathrm{Im}\left[s(t)\right] \times \sin(2\pi F_{UC}t).$$

where F_{UC} is the frequency shift introduced by the RF modulator. The range of F_{UC} and its valid values are specified in §7.1.4.6.

After RF up-conversion, the center frequency around which the spectrum of the transmit OFDM signal will be placed is $F_{UC} + F_{US}$.

7.1.4.5 Preamble

7.1.4.5.1 General preamble structure

Preamble is prepended to every PHY frame defined in §7.1.2.1. It is intended to assist the receiver detecting, synchronizing to the packet boundaries, and acquiring the physical layer parameters such as channel estimation and OFDM symbol alignment. Preamble shall meet the same transmit PSD mask (i.e., notches, shapes) as the header and the payload symbols.

Table 7-27 presents the general structure of G.9960 preamble. Each section i comprises N_i repetitions of an OFDM symbol (S_i) employing sub-carrier spacing $k_i \times F_{SC}$, where F_{SC} denotes the sub-carrier spacing of the payload. A zero value for N_i means that section i is not included in the preamble. The values of k_i shall be selected from the set 1, 2, 4 or 8. The preamble sub-carriers of section i shall be one in every k_i sub-carriers with respect to the sub-carriers used for the payload OFDM symbol starting from sub-carrier zero. Each preamble section shall be windowed as necessary in order to comply with the PSD mask. This is illustrated in Figure 7-21.

Table 7-27/G.9960 – General structure of preamble

	1st Section	2nd Section	3rd Section	Header	4th Section
Number of Symbols (N_i) (Note 1)	N_1	N_2	N_3	Note 5	N_4
Sub-carrier spacing ($k_i \times F_{SC}$)	k_1	$k_2 = k_1$ (Note 2)	k_3		$k_4 = 1$ (Note 3)
OFDM Symbol (S_i)	S_1	$S_2 = -S_1$ (Note 4)	S_3		S_4
Note 1: N_i does not include windowing. Note 2: The sub-carrier spacing of the 2nd section shall be equal to the sub-carrier spacing of the 1st section. Note 3: The sub-carrier spacing of the 4th section shall be the same as sub-carrier spacing of PHY-frame header and payload. Note 4: The OFDM symbol of the 2nd section shall be an inverted time-domain waveform of the 1st section. Note 5: Header contains a field (PHI) that indicates $N_4 = 1$ or $N_4 = 0$					

Figure 7-21 shows the G.9960 preamble waveform.

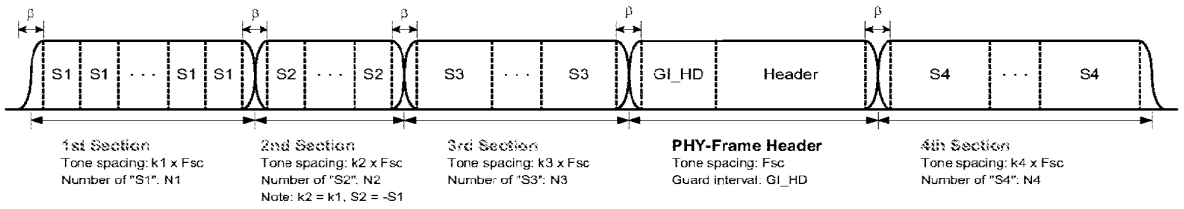


Figure 7-21/G.9960 – Preamble waveform

The number of repetitions of OFDM symbol S_i (N_i) in each of the preamble sections may be a non-integer number to incorporate optional guard interval between sections provided that a fraction of N_i conforms the requirement on the guard interval specified in Table 7-28. The specific preamble types and construction methods are defined in §7.2.

7.1.4.5.2 Preamble generation

This section contains the description of preamble generation method, which is not medium dependent. The preamble generation method specific to the type of medium is described under §7.2.

7.1.4.5.2.1 Frequency-domain symbol generation

The sub-carriers of the i section of the preamble shall be 1 every k_i sub-carriers with respect to the indices of the sub-carriers used for the payload OFDM symbol starting from sub-carrier zero. Preamble generator shall output complex values Z_i for each sub-carrier $i = 0, 1, 2, \ldots$ to be modulated onto symbols of the preamble in accordance with the relevant sub-carrier mask.

7.1.4.5.2.1.1 Modulation of the preamble symbol

The non-masked preamble's sub-carriers shall be modulated using a default reference BPSK sequence, of all 1's. Other reference sequences are for further study. The reference sequence shall be subsequently rotated as specified in §7.1.4.3.3 (Constellation scrambler).

The LFSR generator shall be initialized at the beginning of each one of the used preamble sections to a seed that is preamble section and medium dependent as defined in §7.2.

For non-masked preamble's sub-carrier i, Zi shall be generated by rotating Pi using the two bits that are the LSBs of the LFSR, s1, and s2, as defined in Table 7-26.

The LFSR shall be advanced by 2 bits for each preamble's sub-carrier (either masked or not).

7.1.4.5.2.2 Time-domain symbol generation

The Zi values shall be modulated onto OFDM symbols as described in §7.1.4.4.1.

The output time domain symbol shall be repeated Ni times where Ni denotes the number of replicas within section i. If either N_1 or N_3 are non-integer numbers, the fraction of the symbol replica shall be at the beginning of the section. If N_2 is a non-integer number, the fraction of the symbols replica shall be at the end of the section.

The first, second and third sections of the preamble shall be windowed, overlapped and added as described below:

1. First section:
    a. The first short symbol of the first section is cyclically extended by prepending β/2 samples

1874 b. The last short symbol of the first section is cyclically extended by appending β/2
1875 samples
1876 c. The first and last β samples of the extended first section are windowed with a
1877 window function $w_\beta(n)$ and $w_\beta(\beta-n-1)$ respectively.
1878 2. Second section:
1879 a. The first short symbol of the second section is cyclically extended by prepending β/2
1880 samples
1881 b. The last short symbol of the second section is cyclically extended by appending β/2
1882 samples
1883 c. The first and last β samples of the extended second section are windowed with a
1884 window function $w_\beta(n)$ and $w_\beta(\beta-n-1)$ respectively.
1885 3. Third section:
1886 a. The beginning of the third section is cyclically extended by prepending β samples.
1887 b. The first and last β samples of the extended third section are windowed with a
1888 window function $w_\beta(n)$ and $w_\beta(\beta-n-1)$ respectively.
1889 4. Overlap and add:
1890 a. The β windowed samples at the end of the first section and at the beginning of the
1891 second section are overlapped and added.
1892 b. The β windowed samples at the end of the second section and at the beginning of the
1893 third section are overlapped and added.
1894 c. The β windowed samples at the end of the third section are overlapped and added
1895 with the β windowed samples at the beginning of the PHY-frame header as
1896 described in §7.1.4.4.4
1897
1898 $w_\beta(n)$ shall comply with the rules specified in §7.1.4.4.4
1899 This is illustrated in Figure 7-22.
1900

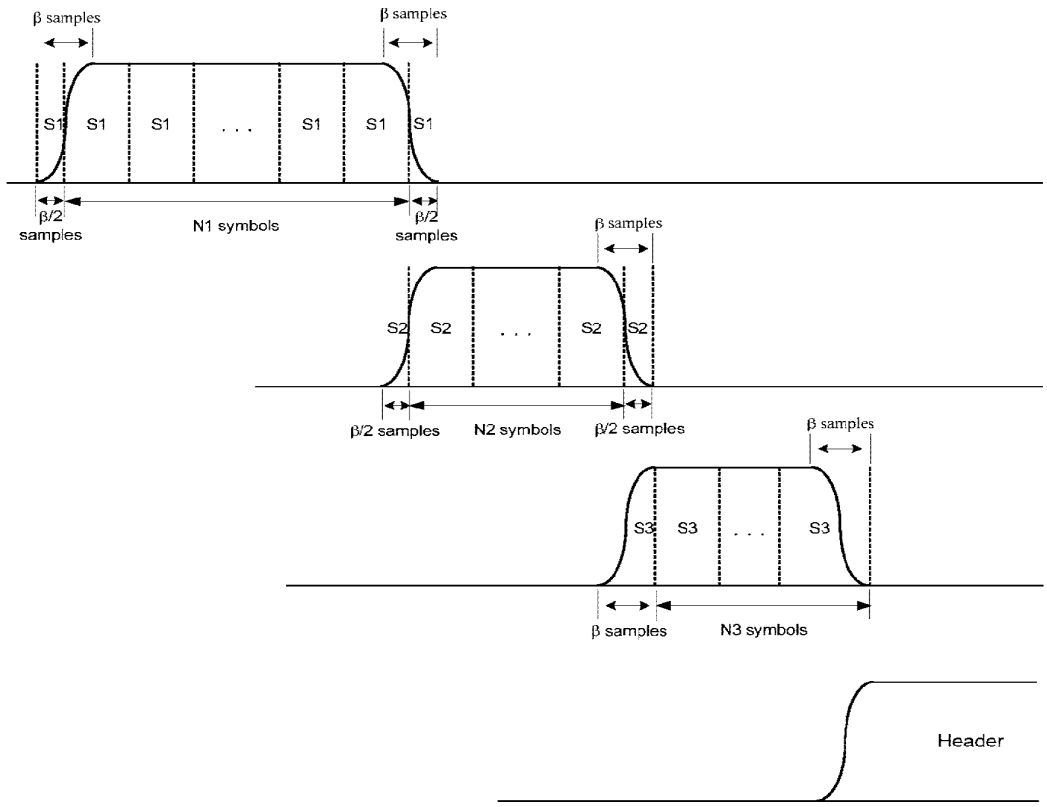


Figure 7-22/G.9960 – Preamble time domain generation

The number of samples in the preamble shall be:

$$N_{pr} = \beta + N_1 \frac{N}{k_1} + N_2 \frac{N}{k_2} + N_3 \frac{N}{k_3}$$

Other approaches for the transition region between the first and second sections of the preamble that meet the EVM and PSD requirements are allowed.

EVM requirements for the preamble are for further study.

7.1.4.6 PMD control parameters

Table 7-28 summarizes valid values of control parameters of an OFDM modulator described in the sections above. This list is a superset of parameters used over different media; a list of valid values of modulation parameters and their valid combinations for particular media is presented is §7.2.

1913 **Table 7-28/G.9960 – Valid OFDM control parameters**

Notation	Parameter	Valid values or range	Note
N	Number of sub-carriers	256, 512, 1024, 2048, 4096	
F_{SC}	Sub-carrier spacing [kHz]	$24.4140625 \times k$, k = 1, 2, 4, 8, 16, 32, 64	
N_{GI}	Guard interval [samples]	$k \times N/32$, k = 1, 2, 3, … 8	
$N_{GI\text{-}HD}$	Guard interval of the header	$N/4$	
$N_{GI\text{-}DF}$	Default guard interval of the payload	$N/4$	$N_{GI\text{-}DF} \geq N_{GI}$
β	Window size [samples]	Any integer between 0 and $N/4$	Range 0-$N/4$
F_{US}	Up-shift frequency, [kHz]	$m \times F_{SC}$, $m \geq N/2$	m is an integer; valid values of m are specified in §7.2
F_{UC}	Center frequency, [kHz]	$F_{UC} = l \times F_G$ where valid values for l are a subset of the range of integers between 13 and 99 F_G = 25 MHz	RF applications only Valid values of l are specified in §7.2.3
NOTE – Guard interval and Window size are expressed in samples at Nyquist rate.			

1914

1915

1916 Secondary parameters of the OFDM modulator allow for performance estimation and are presented
1917 in Table 7-29.

1918 **Table 7-29/G.9960 – Secondary parameters of the modulator**

Notation	Parameter	Note
BW	Total bandwidth [Hz]	$BW = N \times F_{SC}$
N_W	Total number of samples in an OFDM symbol	$N_W = N + N_{CP}$
f_{OFDM}	Symbol rate [symbols/s]	$f_{OFDM} = \frac{N \times F_{SC}}{N + N_{CP} - \beta}$
T_{OFDM}	Symbol period [s]	$T_{OFDM} = 1/f_{OFDM}$
N_{GI}	Guard interval	$N_{GI} = N_{CP} - \beta$

1919

1920 **7.1.4.7 Symbol boost**

1921 Symbols of preamble and header can be sent with higher power (boosted) relative to the symbols of
1922 the payload. The boosting shall be achieved by increasing the power of each active sub-carrier in
1923 the boosted symbol by the same value in dB. Details of symbol boost are for further study.

7.1.5 Transmit PSD Mask

Transmit PSD mask is a superposition of a Sub-carrier Mask (SM), a PSD Shaping Mask (PSM), and a PSD ceiling (PSDC) defined in this section, and the Limit PSD Mask (LPM) defined for each particular medium. The PSD of the transmit signal at any frequency shall never exceed the Transmit PSD Mask.

The LPM (see §7.2.1.3, §7.2.2.3 and §7.2.3.3) specifies the absolute limit of the transmit PSD, intended for deployments with no special conditions. The SM, PSDC, and PSM provide further reduction and shaping of the transmit PSD using three mechanisms: sub-carrier masking (notching), PSD ceiling (limit on PSD level), and PSD shaping.

G.9960 transceivers shall support sub-carrier masking, notching of International Amateur radio bands, and PSD ceiling. Support of PSD shaping is optional.

7.1.5.1 Sub-carrier masking (notching)

This type of shaping shall be used to eliminate transmission on one or more sub-carriers. Sub-carrier masking is defined by a Sub-carrier Mask (SM). Transmit power of sub-carriers specified in SM shall be set to zero. SM shall override all other instructions related to the transmit power of the sub-carrier.

SM is defined as a number of masked frequency bands. Each band is specified by a start sub-carrier index (x_L) and a stop sub-carrier index (x_H), as $\{x_L, x_H\}$. An SM including S bands can be represented in the following format:

$$SM(S) = [\{x_{L1}, x_{H1}\}, \{x_{L2}, x_{H2}\}, \ldots \{x_{LS}, x_{HS}\}].$$

All sub-carriers within the band, i.e., with indices equal or higher than x_L and lower than or equal to x_H, shall be switched off (transmitted with zero power).

International Amateur radio bands (see Annex D) are not a part of SM. In case Amateur radio bands are used for transmission, the node shall be capable to turn off one or more of Amateur radio bands using SM, by configuring one or more of SM bands coinciding with the Amateur radio bands.

7.1.5.2 PSD ceiling

PSD ceiling (PSDC) specifies the PSD level that is used to impose a limit (i.e., a ceiling function) on the transmit PSD mask. PSDC is independent of frequency and indicated by a single value in dBm/Hz. The valid range of PSDC values is from −50 dBm/Hz to −100 dBm/Hz with steps of 2 dB.

PSDC shall be supported by all G.9960 transceivers.

7.1.5.3 PSD shaping

PSD shaping allows transmit PSD reduction of PSD in some parts of the spectrum, mainly for spectrum compatibility and coexistence with other HN technologies. PSD shaping is specified by a PSM.

PSM is defined on the frequency range between the lowest sub-carrier x_1 and the highest sub-carrier x_H allowed for transmission, and consists of one or more frequency segments. The boundaries of the segments are defined by set breakpoints. Inside of each segment, PSD may be either constant or may form a linear slope, Figure 7-23.

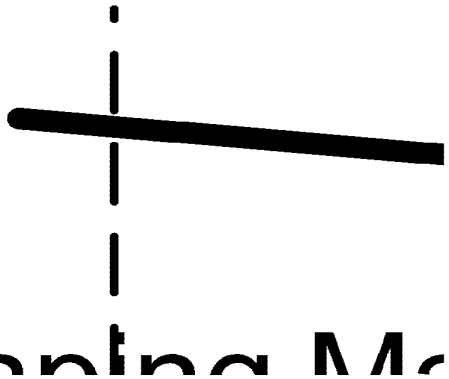


Figure 7-23/G.9960 – Construction of PSM

Each breakpoint of PSM is specified by a sub-carrier index x_n and a value of PSD_n at that sub-carrier expressed in dBm/Hz, $\{x_n, PSD_n\}$. The first breakpoint is always set to the lowest sub-carrier allowed for transmission (index x_1) and the last breakpoint is set to the highest sub-carrier allowed for transmission (index x_H). A PSM including S segments can be represented by (S+1) breakpoints in the following format:

$$\text{PSM}(S) = [\{x_1, PSD_1\}, \{x_2, PSD_2\} \ \ldots \ \{x_S, PSD_S\}, \{x_H, PSD_H\}].$$

A node supporting PSD shaping, shall support up to 8 PSM breakpoints. If a node does not support PSD shaping, all sub-carriers subject to the PSD shaping requirement specified by PSM shall be masked (switched off).

The maximum steepness of PSM slopes is for further study.

If one or more PSM breakpoints are set above the LPM or PSDC, the transmit PSD mask shall be set to: TxPSD = min(PSM, LPM, PSDC). At least one of PSM breakpoints shall be on the LPM (this breakpoint corresponds to tss = 1). All values of PSD_n of PSM breakpoints shall be set above PSM_{min}. The value of PSM_{min} shall not be more than 30 dB below the peak of the PSD mask.

NOTE: PSM breakpoints do not have any relation with SM breakpoints; SM and notched International Amateur radio bands always overrides PSM if defined over the same indices.

7.1.5.4 Notching of International Amateur radio bands

Any node operating over phone line or power line shall be able to reduce the PSD of the transmitted signal to a level below −80 dBm/Hz in all International Amateur radio bands (see Annex D) simultaneously or in any selected group of them. The band to be notched is specified by the start and stop sub-carrier indices, same as described in §7.1.5.1. The PSD slopes forming a notch are vendor discretionary.

7.2 Media dependent specification

7.2.1 Physical layer specification over phone lines

7.2.1.1 Control parameters

Table 7-30 shows the OFDM control parameters for various bandplans defined in phone lines.

1995 **Table 7-30/G.9960 – OFDM control parameters for phone lines**

Domain Type	Phone Line Baseband	
Bandplan Name	**50MHz – TB (NOTE 2)**	**100MHz – TB (NOTE 3)**
N	1024	2048
F_{SC}	48.828125 kHz	48.828125kHz
N_{GI}	$N/32 \times k$ for k=1,…,8 samples @ 50 Msamples/s	$N/32 \times k$ for k=1,…,8 samples @ 100 Msamples/s
$N_{GI\text{-}HD}$	N/4 = 256 samples @ 50 Msamples/s	N/4 = 512 samples @ 100 Msamples/s
$N_{GI\text{-}DF}$	N/4=256 samples @ 50 Msamples/s	N/4=512 samples @ 100 Msamples/s
β	N/32 = 32 samples @ 50 Msamples/s	N/32 = 64 samples @ 100 Msamples/s
F_{US}	25 MHz	50 MHz
$F_C = F_{UC} + F_{US}$	$F_{UC} = 0$	$F_{UC} = 0$
Sub-carrier frequency f for sub-carrier index i (NOTE 1)	$f = i \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)	$f = i \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)
NOTES: 1. See §7.1.4.1 for more details on sub-carrier indexing rules. 2. The range of sub-carrier frequencies is between 0 and 50 MHz 3. The range of sub-carrier frequencies is between 0 and 100 MHz		

1996

1997 **7.2.1.2 Preamble**

1998 **7.2.1.2.1 Default preamble structure**

1999 Table 7-31 illustrates the default preamble structure for phone line.

Table 7-31/G.9960 – Default preamble structure for phone line

	1st Section	2nd Section	3rd Section	Header	4th Section
Number of Symbols (N_i)	8	2	0	NOTE	1.25
Sub-carrier spacing ($k_i \times F_{SC}$)	8	8	0		1
NOTE – The value for PHI in the PHY-frame header shall be set to 1 (N_4).					

7.2.1.3 PSD mask specifications

The Limit PSD mask for operation over phone lines (bandplans 50MHz-TB and 100MHz-TB) shall be as presented in Figure 7-24 with the values of frequencies f_L-f_H as presented in Table 7-32.

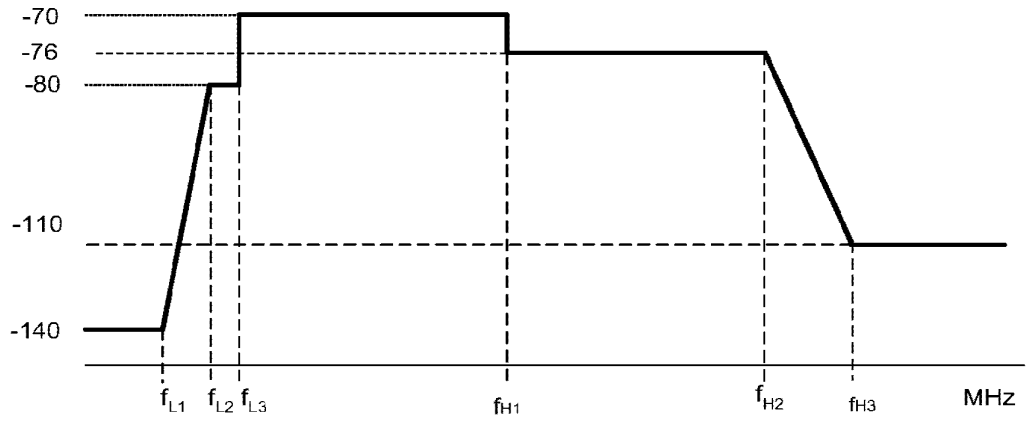


Figure 7-24/G.9960 – Limit PSD mask for transmission over phone lines (Amateur radio-band notches are not shown)

NOTE: Figure 7-24 doesn't include Amateur radio notches.

The values of frequency spectrum parameters for phone lines are presented in Table 7-32. Interim points between those define in Figure 7-24 shall be obtained by linear interpolation (in dB over linear frequency scale).

2014 **Table 7-32/G.9960 – Parameters of Limit PSD mask over phone lines**

Parameters	Frequency, MHz	PSD, dBm/Hz	Note/Description
f_{L1}	1.7	−140	Provides protection of splitter-less ADSL
f_{L2}	3.5	−80	Coincides with the Amateur radio band
f_{L3}	4.0		
$f_{L3}+\Delta F$	$4.0+\Delta F$	−70	ΔF is an arbitrary small positive value
f_{HAM}	As defined in Table D-1	−80	Additional notches can be added based on regional regulations
$f_{H1}-\Delta F$	$30-\Delta F$	−70	ΔF is an arbitrary small positive value
f_{H1}	30	−76	
f_{H2}	100		
f_{H3}	120	−110	
NOTE – All sub-carriers below $f_{L3}+\Delta F$, and above $f_{H2}-\Delta F$, and inside the notched Amateur radio bands shall not be used for transmission (neither data nor any auxiliary information).			

2015
2016

NOTES:

1. The Limit PSD mask shown in Figure 7-24 presents for the case when all sub-carriers allowed for transmission are in use, each with its maximum transmit power. In case of additional spectrum shaping is used as described in §7.1.5.3 (e.g. to provide spectrum compatibility, comply with wide-band power limit, or other), various parts of this PSD mask could be reduced by switching sub-carriers off or reducing their transmit power. Additional frequency notches may be applied if required.

2. VDSL is usually deployed using a service splitter (G.993.2 doesn't encourage splitterless VDSL installations). This allows the use of the G.9960 spectrum down to f_{L3}. If splitterless VDSL is used, the low frequency of G.9960 spectrum shall be moved up and set above the upper downstream sub-carrier of VDSL2.

7.2.2 Physical layer specification over power lines

7.2.2.1 Control parameters

Table 7-33 shows the OFDM control parameters for various bandplans defined in power lines.

2034 **Table 7-33/G.9960 – OFDM control parameters for power lines**

Domain Type	Power Line Baseband		Power Line Passband
Bandplan Name	**50MHz – PB (NOTE 3)**	**100MHz – PB (NOTE 4)**	**100MHz – PP (NOTE 5)**
N	2048	4096	1024
F_{SC}	24.4140625 kHz	24.4140625 kHz	97.65625 kHz
N_{GI}	$N/32 \times k$ for k=1,…,8 samples @ 50 Msamples/s	$N/32 \times k$ for k=1,…,8 samples @ 100Msamples/s	$N/32 \times k$ for k=1,…,8 samples @ 100Msamples/s
$N_{GI\text{-}HD}$	N/4=512 samples @ 50 Msamples/s	N/4=1024 samples @ 100 Msamples/s	N/4=256 samples @ 100 Msamples/s
$N_{GI\text{-}DF}$	N/4=512 samples @ 50 Msamples/s	N/4=1024 samples @ 100 Msamples/s	N/4=256 samples @ 100 Msamples/s
β	N/8 = 256 samples @ 50 Msamples/s	N/8 = 512 samples @ 100 Msamples/s	N/32 = 32 samples @ 100 Msamples/s
F_{US}	25 MHz	50 MHz	150 MHz
$F_C = F_{UC} + F_{US}$	$F_{UC} = 0$	$F_{UC} = 0$	$F_{UC} = 0$
Sub-carrier frequency f for sub-carrier index i (NOTE 1)	$f = i \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)	$f = i \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)	$f = F_{US} - (N/2 - i) \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)

NOTES:
1. See §7.1.4.1 for more details on sub-carrier indexing rules.
2. The 50 MHz and 100 MHz bandplans may be used by nodes operating in the same Power Line Baseband domain.
3. The range of sub-carrier frequencies is between 0 and 50 MHz
4. The range of sub-carrier frequencies is between 0 and 100 MHz
5. The range of sub-carrier frequencies is between 100 MHz and 200 MHz

2035

2036 **7.2.2.2 Preamble**

2037 **7.2.2.2.1 Default preamble structure**

2038 Table 7-34 illustrates the default preamble structure for power line.

Table 7-34/G.9960 – Default preamble structure for power line

	1st Section	2nd Section	3rd Section	Header	4th Section
Number of Symbols (N_i)	7	2	0	NOTE	1.25
Sub-carrier spacing ($k_i \times F_{SC}$)	8	8	0		1
NOTE – The value for PHI in the PHY-frame header shall be set to 1 (N_4).					

7.2.2.3 PSD mask specifications

The baseband Limit PSD mask for operation over power lines (bandplans 50MHz-PB and 100MHz-PB) shall be as presented in Figure 7-25 with the values of frequencies f_L-f_H as presented in Table 7-35. The passband Limit PSD mask for operation over power lines (bandplan 100MHz-PP) shall be as defined in Figure 7-26 and Table 7-36.

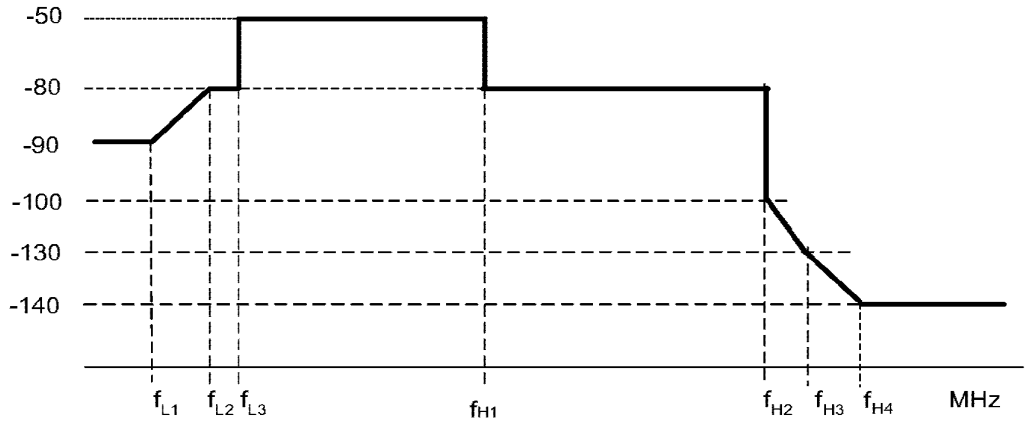


Figure 7-25/G.9960 – Limit PSD mask for baseband transmission over power lines (Amateur radio-band notches are not shown)

NOTE: Figure 7-25 doesn't include Amateur radio notches.

The frequency spectrum parameters for baseband bandplans are presented in Table 7-35. Interim points between those defined in Figure 7-25 are obtained by linear interpolation (in dB over linear frequency scale).

Table 7-35/G.9960 – Parameters of Limit PSD mask for bandplans 50MHz-PB and 100MHz-PB

Parameters	Frequency, MHz	PSD, dBm/Hz	Note/Description
f_{L1}	1.1	−90	Additional reduction below 1.1 MHz is to reduce crosstalk into ADSL
f_{L2}	1.8	−80	Coincides with the Amateur radio band
f_{L3}	2.0		
$f_{L3} + \Delta F$	$2.0 + \Delta F$	−50	ΔF is an arbitrary small positive value
f_{HAM}	As defined in Table D-1	−80	Additional notches could be added based on regional regulations
$f_{H1} - \Delta F$	$30 - \Delta F$	−50	ΔF is an arbitrary small positive value
f_{H1}	30	−80	ΔF is an arbitrary small positive value
f_{H2}	$100 - \Delta F$		
f_{H2}	100	−100	
f_{H3}	110	−130	
f_{H4}	120	−140	
NOTE – All sub-carriers below $f_{L3} + \Delta F$, and above $f_{H2} - \Delta F$, and inside the notched Amateur radio bands shall not be used for transmission (neither data nor any auxiliary information).			

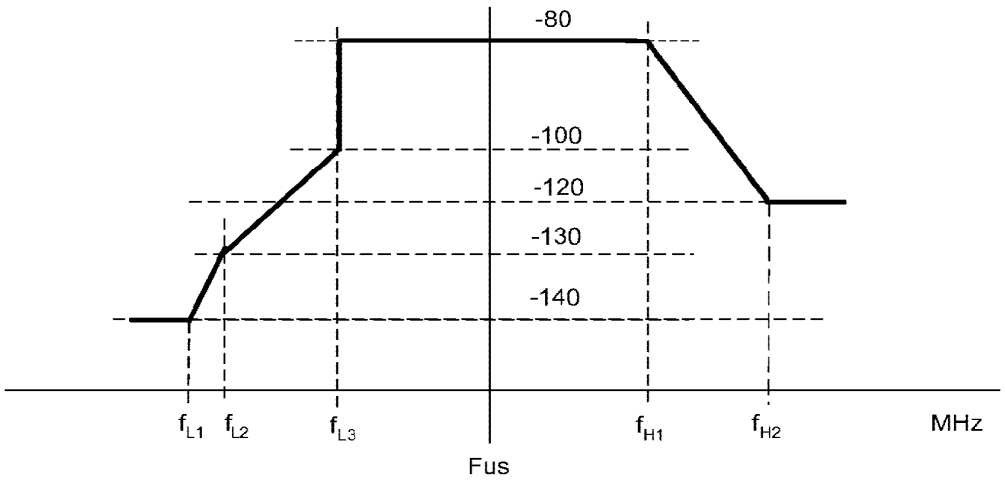


Figure 7-26/G.9960 – Limit PSD mask for passband transmission over power lines

The frequency spectrum parameters for passband bandplans are presented in Table 7-36. Interim points between those defined in Figure 7-26 are obtained by linear interpolation (in dB over linear frequency scale).

Table 7-36/G.9960 – Parameters of Limit PSD mask for bandplan 100MHz-PP

Parameters	Frequency, MHz	PSD, dBm/Hz	Note/Description
f_{L1}	80	−140	
f_{L2}	90	−130	
f_{L3}	100	- 100	
$f_{L3} + \Delta F$	100 + ΔF	-80	ΔF is an arbitrary small positive value
f_{H1}	200	−80	
f_{H2}	240	−120	
All sub-carriers below $f_{L3} + \Delta F$, and above $f_{H1} - \Delta F$, and inside the notched Amateur radio bands will not be used for transmission (neither data nor any auxiliary information).			

NOTES:

1. The Limit PSD mask shown in Figure 7-25 and Figure 7-26 presents the case when all sub-carriers allowed for transmission are in use, each with its maximum transmit power. In case of additional spectrum shaping is used as described in §7.1.5.3 (e.g. to provide spectrum compatibility with VDSL, comply with wide-band power limit, or other), various parts of this PSD mask could be reduced by switching sub-carriers off or reducing their transmit power. Additional frequency notches may be applied if required.

2. The value of −80dBm/Hz for the required attenuation in Amateur radio bands is adopted from [1]. This value might be revised for G.9960 due to concerns of reduced balance of power line wires.

7.2.3 Physical layer specification over coax

7.2.3.1 Control parameters

Table 7-37 shows the OFDM control parameters for various bandplans defined in coax cable.

2080 **Table 7-37/G.9960 – OFDM control parameters for coax cables**

Domain Type	Coax Baseband		Coax RF	
Bandplan Name	**50MHz – CB (NOTE 4)**	**100MHz – CB (NOTE 5)**	**50MHz – RF (NOTE 6)**	**100MHz – RF (NOTE 7)**
N	256	512	256	512
F_{SC}	195.3125 kHz	195.3125 kHz	195.3125 kHz	195.3125 kHz
N_{GI}	$N/32 \times k$ for k=1,…,8 samples @ 50 Msamples/s	$N/32 \times k$ for k=1,…,8 samples @ 100 Msamples/s	$N/32 \times k$ for k=1,…,8 samples @ 50 Msamples/s	$N/32 \times k$ for k=1,…,8 samples @ 100 Msamples/s
$N_{GI\text{-}HD}$	N/4=64 samples @ 50 Msamples/s	N/4=128 samples @ 100 Msamples/s	N/4=64 samples @ 50 Msamples/s	N/4=128 samples @ 100 Msamples/s
$N_{GI\text{-}DF}$	N/4=64 samples @ 50 Msamples/s	N/4=128 samples @ 100 Msamples/s	N/4=64 samples @ 50 Msamples/s	N/4=128 samples @ 100 Msamples/s
β	N/32=8 samples @ 50 Msamples/s	N/32=16 samples @ 100 Msamples/s	N/32=8 samples @ 50 Msamples/s	N/32=16 samples @ 100 Msamples/s
F_{US}	25 MHz	50 MHz	25 MHz	50 MHz
$F_C = F_{UC} + F_{US}$	$F_{UC} = 0$	$F_{UC} = 0$	$F_C = X$ (NOTE 3)	$F_C = Y$ (NOTE 3)
Sub-carrier frequency f for sub-carrier index i (NOTE 1)	$f = i \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)	$f = i \times F_{SC}$ where $i = 0$ to $i = N - 1$ (indexing rule #1)	indexing rule #1 if $X \neq Y$, or indexing rule #2 if $X = Y$. (NOTE 8)	indexing rule #1 if $X \neq Y$, or indexing rule #2 if $X = Y$. (NOTE 8)

NOTES:
1. See §7.1.4.1 for more details on sub-carrier indexing rules.
2. The 50MHz and 100MHz bandplans may be used by nodes operating in the same Coax Baseband domain. The same principle applies to 50MHz and 100MHz bandplans defined for Coax RF domain.
3. The values of center frequency F_C shall be selected from the valid set defined in Table 7-28 and may be subject to regional spectrum management rules (see regional Annexes).
4. The range of sub-carrier frequencies is between 0 and 50 MHz
5. The range of sub-carrier frequencies is between 0 and 100MHz
6. The range of sub-carrier frequencies is between $(X - 25)$ MHz and $(X + 25)$ MHz
7. The range of sub-carrier frequencies is between $(Y - 50)$ MHz and $(Y + 50)$ MHz
8. The specific indexing rule is specified in each regional Annex.

2081

2082 **7.2.3.2 Preamble**

2083 **7.2.3.2.1 Default preamble structure**

2084 Table 7-38 illustrates the default preamble structure for Coax BB.

2085 **Table 7-38/G.9960 – Default preamble structure for coax BB**

	1st Section	2nd Section	3rd Section	Header	4th Section
Number of Symbols (N_i)	10	4	2.5	NOTE	0
Sub-carrier spacing ($k_i \times F_{SC}$)	4	4	1		N/A
NOTE – The value for PHI in the PHY-frame header shall be set to 0 (N_4).					

2086

2087 Table 7-39 illustrates the default preamble structure for Coax RF.

2088 **Table 7-39/G.9960 – Default preamble structure for coax RF**

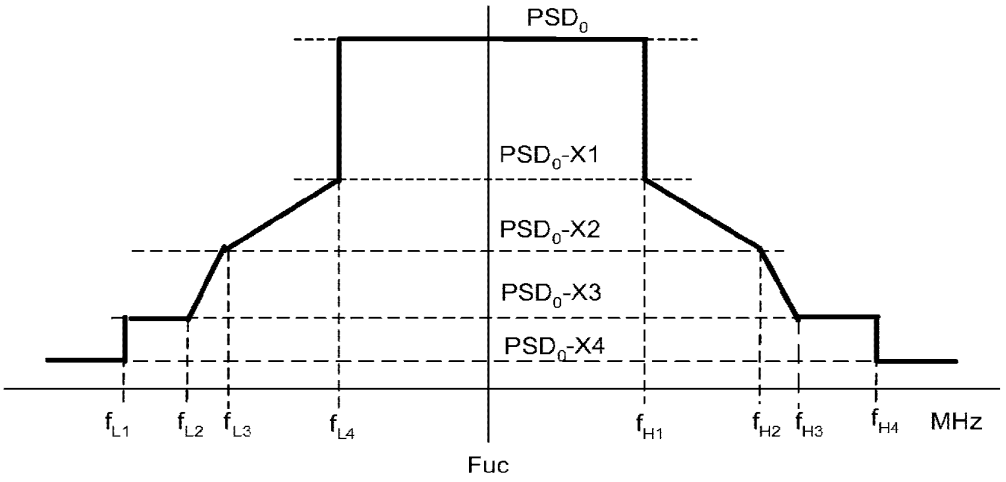
	1st Section	2nd Section	3rd Section	Header	4th Section
Number of Symbols (N_i)	10	4	2.5	NOTE	0
Sub-carrier spacing ($k_i \times F_{SC}$)	4	4	1		N/A
NOTE – The value for PHI in the PHY-frame header shall be set to 0 (N_4).					

2089

2090 **7.2.3.3 PSD mask specifications**

2091 The Limit PSD mask for operation over RF coax (bandplans 50MHz-RF, 100MHz-RF) is presented
2092 in Figure 7-27 with the frequencies as presented in Table 7-40 and with the bandwidth $BW = f_{H1} -$
2093 f_{L3}.

2094



2095

2096 **Figure 7-27/G.9960 - Limit PSD mask of a single channel for RF transmission over coax**

2097 The proposed values of frequency spectrum parameters for coax are presented in Table 7-40 and
2098 Table 7-41. It is assumed that interim points between those defined in Figure 7-27 are obtained by
2099 linear interpolation (dB over linear frequency scale).

Table 7-40/G.9960 – Parameters of Limit PSD mask over RF coax for bandplan 50MHz-RF

Parameters	Frequency, MHz	PSD, dBm/Hz (NOTE)	Note/Description
$F_{UC} - f_{L1}$	75	$PSD_0 - 50$	
$F_{UC} - f_{L2}$	50	$PSD_0 - 45$	
$F_{UC} - f_{L3}$	35	$PSD_0 - 40$	
$F_{UC} - f_{L4}$	25	$PSD_0 - 20$	
	$f_{L4} + \Delta F$	PSD_0	ΔF is an arbitrary small positive value
F_{UC}	M*25MHz	PSD_0	
	$f_{H1} - \Delta F$	PSD_0	ΔF is an arbitrary small positive value
$f_{H1} - F_{UC}$	25	$PSD_0 - 20$	
$f_{H2} - F_{UC}$	35	$PSD_0 - 40$	
$f_{H3} - F_{UC}$	50	$PSD_0 - 45$	
$f_{H4} - F_{UC}$	75	$PSD_0 - 50$	
NOTE – $PSD_0 = -68$ dBm/Hz			

Table 7-41/G.9960 – Parameters of Limit PSD mask over RF coax for bandplan 100MHz-RF

Parameters	Frequency, MHz	PSD, dBm/Hz (NOTE)	Note/Description
$F_{UC} - f_{L1}$	150	$PSD_0 - 50$	
$F_{UC} - f_{L2}$	100	$PSD_0 - 45$	
$F_{UC} - f_{L3}$	70	$PSD_0 - 40$	
$F_{UC} - f_{L4}$	50	$PSD_0 - 20$	
	$f_{L4} + \Delta F$	PSD_0	ΔF is an arbitrary small positive value
F_{UC}	M*25MHz	PSD_0	
	$f_{H1} - \Delta F$	PSD_0	ΔF is an arbitrary small positive value
$f_{H1} - F_{UC}$	50	$PSD_0 - 20$	
$f_{H2} - F_{UC}$	70	$PSD_0 - 40$	
$f_{H3} - F_{UC}$	100	$PSD_0 - 45$	
$f_{H4} - F_{UC}$	150	$PSD_0 - 50$	
NOTE – $PSD_0 = -68$ dBm/Hz			

NOTES:

1. All sub-carriers below $f_{L4} + \Delta F$, above $f_{H1} - \Delta F$ will not be used for transmission (neither data nor any auxiliary information).

2. The Limit PSD mask shown in Figure 7-27 presents the case when all sub-carriers allowed for transmission are in use, each with its maximum transmit power. In case additional spectrum shaping is used, as described in §7.1.5.3, the transmit PSD mask can be reduced in the relevant parts of this spectrum by switching sub-carriers off or reducing their transmit power.

3. In cases when more than one channel is established over the same coax cable, appropriate gaps between center frequencies of the channels should be set to account values of the out-of-band PSD presented in Table 7-40 and Table 7-41.

4. Out-of-band spurious signals at the output of G.9960 node operating over coax in RF mode are supposed to meet the Limit PSD mask defined in Table 7-40 and Table 7-41. The limit for total power of out-of-band spurious signals is for further study. The requirements for in-band spurious signals are for further study.

5. Specification of guard bands are for further study.

The Limit PSD mask for operation over baseband coax (bandplans 50MHz-CB, 100MHz-CB) is presented in Figure 7-28 with the frequencies and PSD levels presented in Table 7-42, Table 7-43 and with the bandwidth $BW = f_{H1} - f_{L2}$.

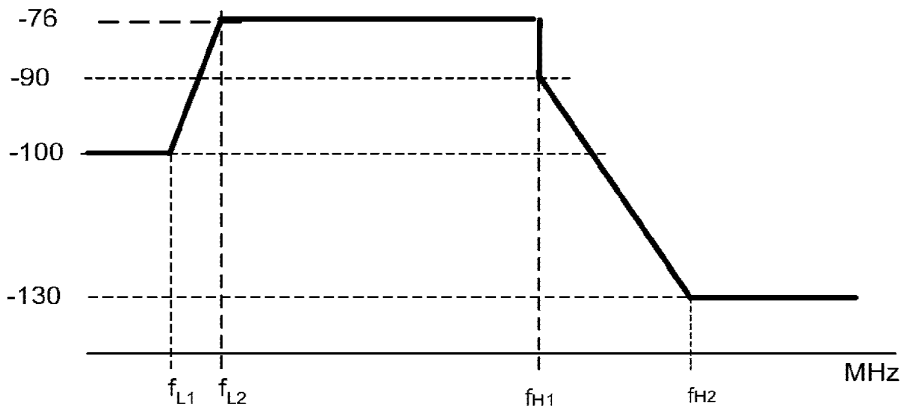


Figure 7-28/G.9960 - Limit PSD mask of baseband coax

The interim points between those defined in Figure 7-28 are obtained by linear interpolation (dB over linear frequency scale).

Table 7-42/G.9960 – Parameters of Limit PSD mask over coax for bandplan 50 MHz-CB

Parameters	Frequency, MHz	PSD, dBm/Hz	Note/Description
f_{L1}	1	−100	
f_{L2}	5	-76	
$f_{H1} - \Delta F$	$50 - \Delta F$	-76	ΔF is an arbitrary small positive value
f_{H1}	50	-76	
f_{H2}	70	−135	

Table 7-43/G.9960 – Parameters of Limit PSD mask over coax for bandplan 100MHz-CB

Parameters	Frequency, MHz	PSD, dBm/Hz	Note/Description
f_{L1}	1	−100	
f_{L2}	5	-76	
$f_{H1} - \Delta F$	$100 - \Delta F$	-76	ΔF is an arbitrary small positive value
f_{H1}	100	-76	
f_{H2}	140	−135	

NOTES:

1. All sub-carriers below f_{L2} and above f_{H1} - ΔF will not be used for transmission (neither of data nor of any auxiliary information).

2. The Limit PSD mask shown in Figure 7-28 presents the case when all sub-carriers allowed for transmission are in use, each with its maximum transmit power. In case additional spectrum shaping is used, as described in §7.1.5.3, the transmit PSD mask can be reduced in the relevant parts of this spectrum by switching sub-carriers off or reducing their transmit power.

7.2.3.4 Coexistence on coax

G.9960 nodes on coax shall use specified detection and frequency agility capabilities and procedures to avoid interfering with non-G.9960 networks and other services (e.g., communication and broadcast services) operating on the same coax plant. Details of these capabilities and procedures will be specified in a future version of this Recommendation.

7.2.4 Transmitter EVM Requirements

EVM requirements are for further study.

Annex A – Regional requirements for North America

For further study

Annex C – Regional requirements for Japan

C.1 Scope

This annex describes domestic practices, standards for each medium (coax cable, phone line and power line) and the way to apply the G.9960 system under those conditions in Japan.

C.2 Media dependent specification

C.2.1 Physical layer specification over phonelines

For further study.

C.2.2 Physical layer specification over powerlines

C.2.2.1 Frequency use for powerlines

All HN nodes over powerlines shall comply with national regulations in Japan [1], which states the frequency band that one can use without any license is restricted to between 2 MHz and 30 MHz, and the interference level due to power line communication is also restricted.

Furthermore, the regulations give limitations of where they can be used; that is, the usage of power line communications is only limited inside buildings and not allowed outside buildings.

C.2.3 Physical layer specification over coax

C.2.3.1 Bandplan

In addition to the OFDM control parameters in Table 7-37, the OFDM control parameters shown in Table C-1 may be used. It should be noted that coaxial home network connected to cable access network should not interfere the services offered by the cable television operator to customers.

2177 **Table C-1/G.9960 – Optional OFDM control parameters for coax cables in Japan**

Domain Type	**Coax RF**
Bandplan Name	**200MHz – RF (NOTES 2, 3)**
N	1024
F_{SC}	195.3125 kHz
N_{GI}	For further study
$N_{GI\text{-}HD}$	For further study
$N_{GI\text{-}DF}$	For further study
β	For further study
F_{US}	100 MHz
$F_C = F_{UC} + F_{US}$	$F_C = Z$ (NOTE 4)
Sub-carrier frequency f for sub-carrier index i (NOTE 1)	Indexing rule #2 if X=Y=Z, otherwise #1. (NOTE 5)
NOTES: 1. See §7.1.4.1 for more details on sub-carrier indexing rules. 2. The 200MHz bandplan on this table and the 50MHz and 100MHz bandplans shown in Table 7-37 may be used by nodes operating in the same Coax RF domain. 3. The range of sub-carrier frequencies is between (Z – 100) MHz and (Z + 100) MHz 4. The values of center frequency F_C shall be selected from the valid set defined in Table 7-28 and may be subject to regional spectrum management rules. 5. X and Y are F_C of bandplan 50MHz-RF and 100MHz-RF respectively (See Table 7-37).	

2178

2179 **C.2.3.2 Transmitter EVM Requirements for RF coax**

2180 The EVM requirements are for further study.

2181 **C.3 Bibliography**

2182 [1] Radio wave Law enforcement regulations 46-2 (Japanese), http://law.e-
2183 gov.go.jp/htmldata/S25/S25F30901000014.html
2184

Annex D – International Amateur radio bands

Table D-1/G.9960 – International Amateur radio bands in the frequency range 0-30 MHz

Band start (kHz)	Band stop (kHz)
1 800	2 000
3 500	4 000
7 000	7 300
10 100	10 150
14 000	14 350
18 068	18 168
21 000	21 450
24 890	24 990
28 000	29 700

Appendix I: Consideration of Domains Comprising Multiple Wire Classes

The focus of the HN network is to optimize domains to operate on each individual wire class with multiple domains interconnected via inter-domain bridges. However, it is possible to interconnect wire classes at the physical layer. Figure I-1 shows several possibilities for such an arrangement. Figure I-1 (A) shows an example network segment comprising coax, phone line and power line. These wires are interconnected at the physical layer; the coax and phone line by a balun, and the phone line and power line by a high-pass filter. Figure I-1 (B) shows a similar case except that the power line segment is no longer connected at the physical layer, instead connecting to the phone line segment via an inter-domain bridge. The physical layer interconnections shown in Figure I-1 are expected to be a small subset of the wiring scenarios encountered when installing an HN network, and it is assumed that such practices will be avoided if possible.

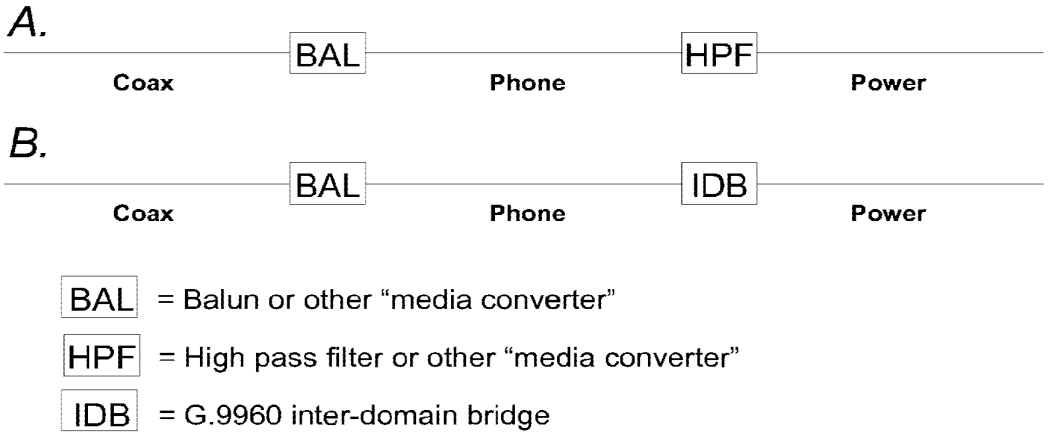


Figure I-1/G.9960 – Example network segments with multiple wire classes connected at the physical layer

By definition a medium is a wire-line facility, of a single wire class, allowing physical connection between network nodes. For the types of cases shown in Figure I-1, having multiple wire classes interconnected by physical layer connections, a medium may be considered to comprise the multiple wire classes and the devices interconnecting them. Given this consideration, a domain may operate over this extended medium. This special use of the term, *medium*, is demonstrated in Figure I-2.

Figure I-2 shows the same network segments given in Figure I-1, and a relative comparison to the relationships between domain, medium and wire class that is shown in Figure 5-5. The allowance for a medium to comprise multiple wire classes in this special case also permits a domain to extend across multiple wire classes that are connected at the physical layer. Figure I-2 (A) shows a domain covering the physically connected coax, phone line and power line segments from Figure I-1 (A), and Figure I-2 (B) similarly shows the physically connected coax and phone line segments of Figure I-1 (B) as well as showing the separate power line domain. Figure I-2 (C) highlights the

capability to have multiple domains, showing two domains (with implied inter-domain bridging) over the coax/phone line combination from Figure I-2 (B).

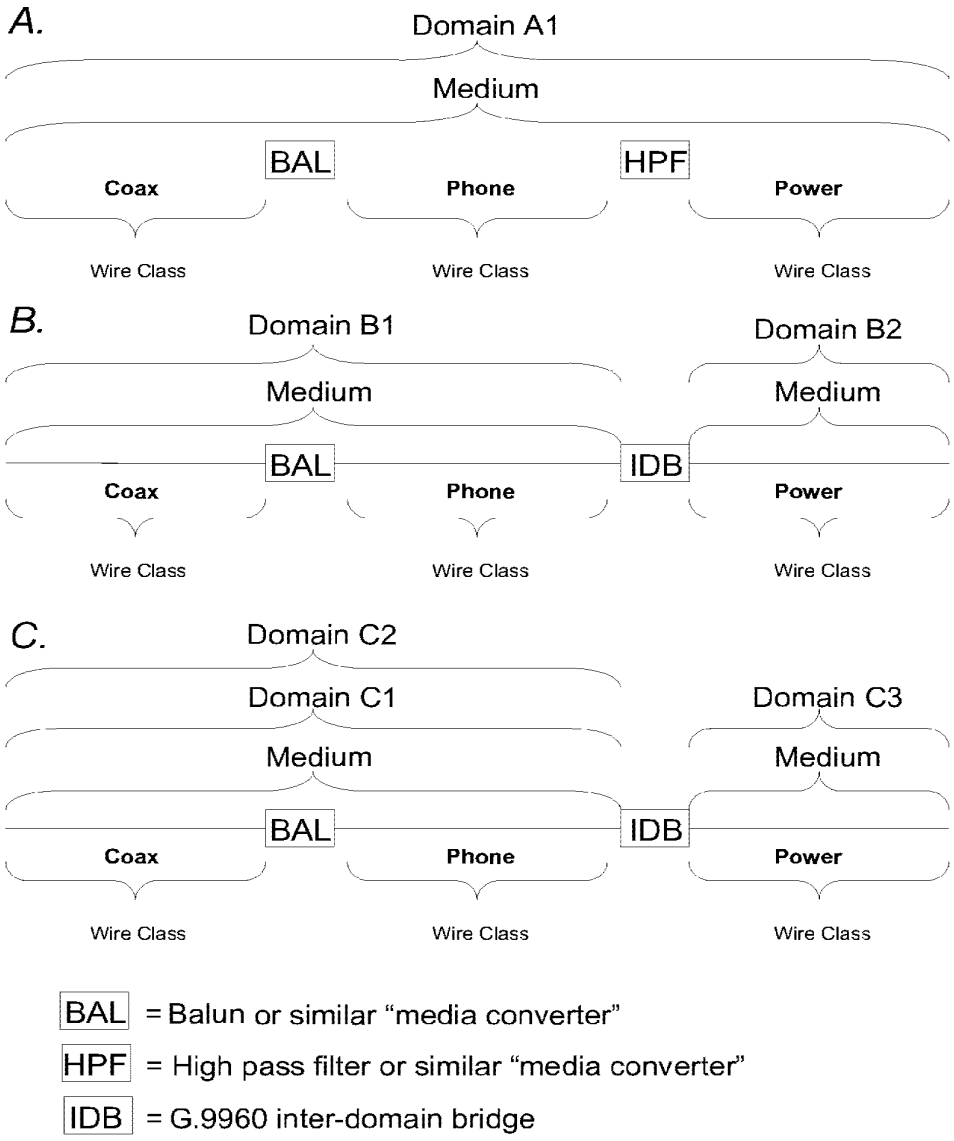


Figure I-2/G.9960 – Example network segments applying special use of the term, *medium*

Appendix II: Examples of HN topologies

An example of HN containing a single domain is shown in Figure II-1 where a single Domain Master coordinates nodes of the domain (i.e. assigns bandwidth resources and priority). In this example, the domain is bridged to the Access Network via the Node D (it is also a Domain Master) which is assumed to be part of the Residential Gateway. In PM nodes A, B, C, and D communicate directly to each other. In CM one of the nodes is assigned as DAP (Node D in this example), and all nodes can communicate to each other only via this node. In UM each of the nodes A-D can communicate directly to each other or indirectly, via other nodes operating as Relay nodes. In this example, Node D (Domain Master) serves as a Relay Node, while other nodes use either PP type of communication or Node D as a relay if required.

While in either PM, CM or UM, nodes A-D can transmit under limitation of bandwidth resources and priorities assigned by the Domain Master.

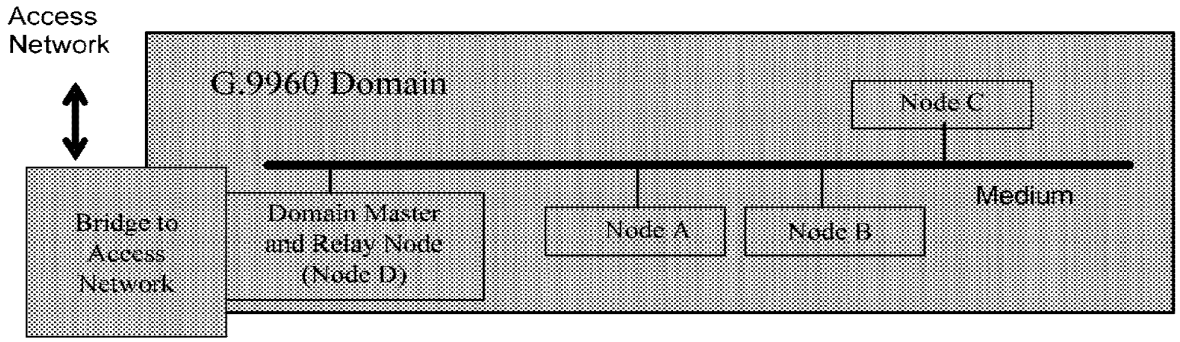
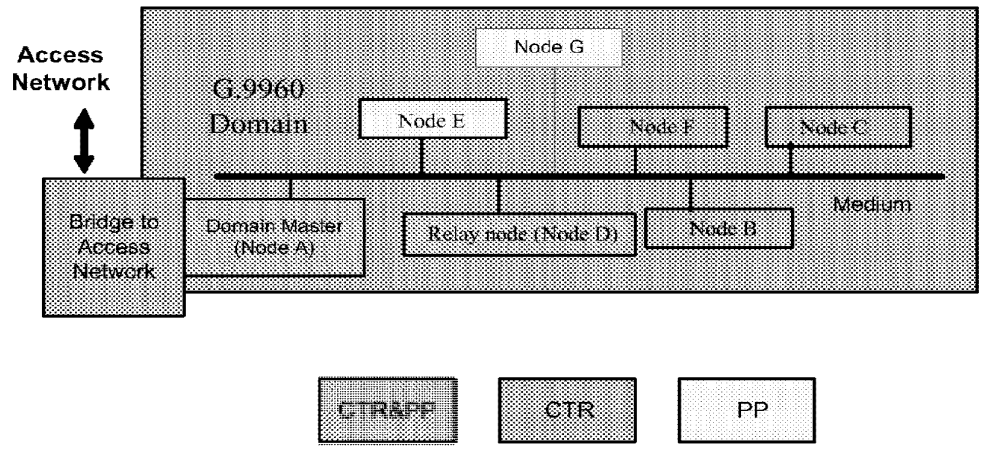


Figure II-1/G.9960 – Example of HN containing single domain

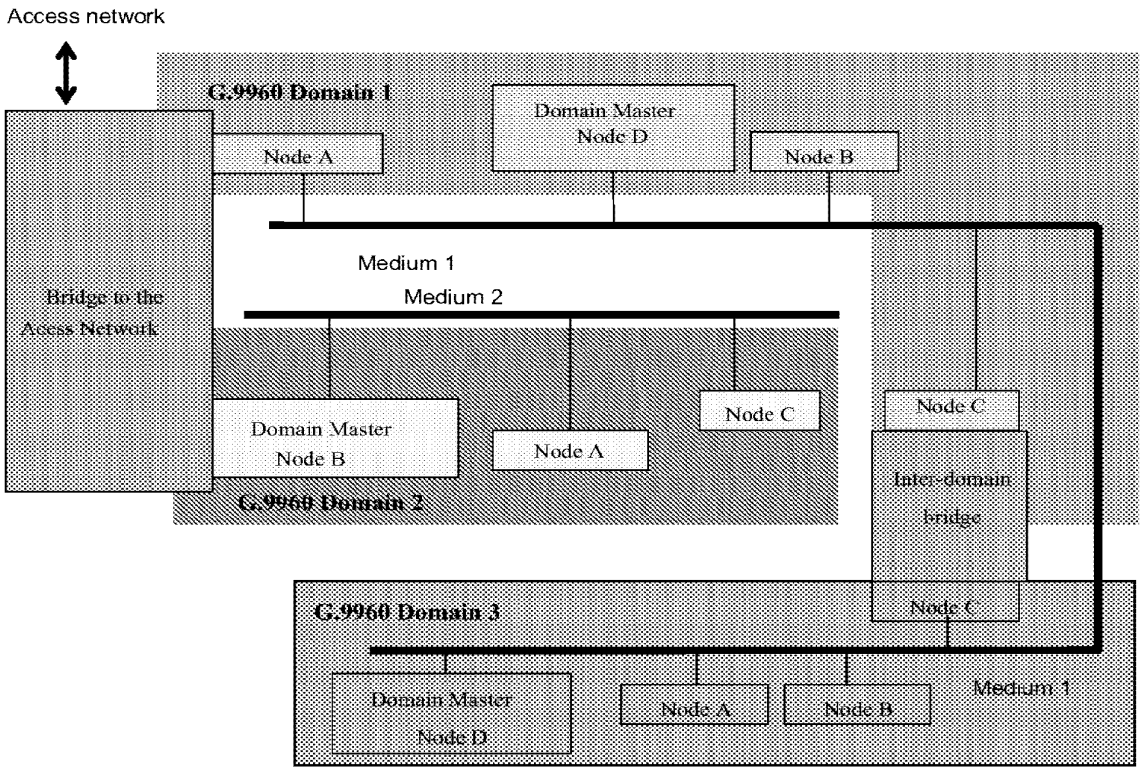
An example of HN containing a single domain that operates in UM using both CTR and PP types of communication is depicted in Figure II-2. The subset of nodes that use CTR type of communication includes nodes B, C, D and F where Node D operates as a Relay node for this group of nodes. All other nodes can communicate directly (i.e., PP type) or via a Relay node (i.e., CTR type). A single Domain Master (in this case Node A) coordinates the HN nodes of the domain. The domain is bridged to the Access Network via Node A, which is assumed to be part of the Residential Gateway. While either using PP or CTR type of communication, Nodes A through G can transmit under the limitation of bandwidth resources and priorities assigned by the Domain Master. Packets from nodes B, C and F addressed to nodes outside the domain are sent to Node A via the relay Node D; Node A is connected to the inter-domain bridge. Packets from nodes D, E and G addressed to nodes outside the domain are sent to node A directly.



2250

2251 **Figure II-2/G.9960 – Example of HN containing single domain using UM (combined PP&**
2252 **CTR)**

2253 An example of HN containing three domains with corresponding Domain Masters established on
2254 two different media is depicted in Figure II-3. Nodes of domain 1 and of domain 3 operate over the
2255 same medium (medium 1). In this example, it is assumed that domain 1 and domain 3 operate on
2256 different spectrum bands. Those two domains are bridged via an inter-domain bridge (on Layer 2 or
2257 Layer 3). Domain 2 operates on a different medium (denoted as medium 2). Domains 1 and 2 are
2258 bridged to the Access Network. In Figure II-3 it is assumed that the Domain Master of domain 2
2259 and Node A of domain 1 are parts of the Residential Gateway. Domains 1 and 3 are connected by
2260 an inter-domain bridge. Each of three domains can operate in either PM, UM or CM mode of
2261 operation, independently of the operation mode used by other domains.



2262

2263

2264 **Figure II-3/G.9960 – Example of HN comprising three domains**

2265 An example of a network containing HN and an Alien domain is shown in Figure II-4. The example
2266 shows an HN network containing two domains (domains 1 and 2) with corresponding Domain
2267 Masters established on two different media and bridged via an inter-domain bridge (Layer 2 or
2268 Layer 3). An Alien domain is established on the same medium as domain 1 and bridged to the HN
2269 (on Layer 2 or Layer 3). HN nodes of domain 1 and of domain 2 in Figure II-4 operate over
2270 different media, while nodes A1-A3 which are non-HN nodes, share the same medium with domain
2271 1. The Domain Master of domain 1 considers the Alien domain as another network client connected
2272 to the corresponding HN node of domain 1. Operation of this Alien domain and its interconnection
2273 with HN is out of scope of G.9960.

2274 In this example, Node A of domain 1 is bridged to the Access network. This bridge is usually a part
2275 of the Residential Gateway.

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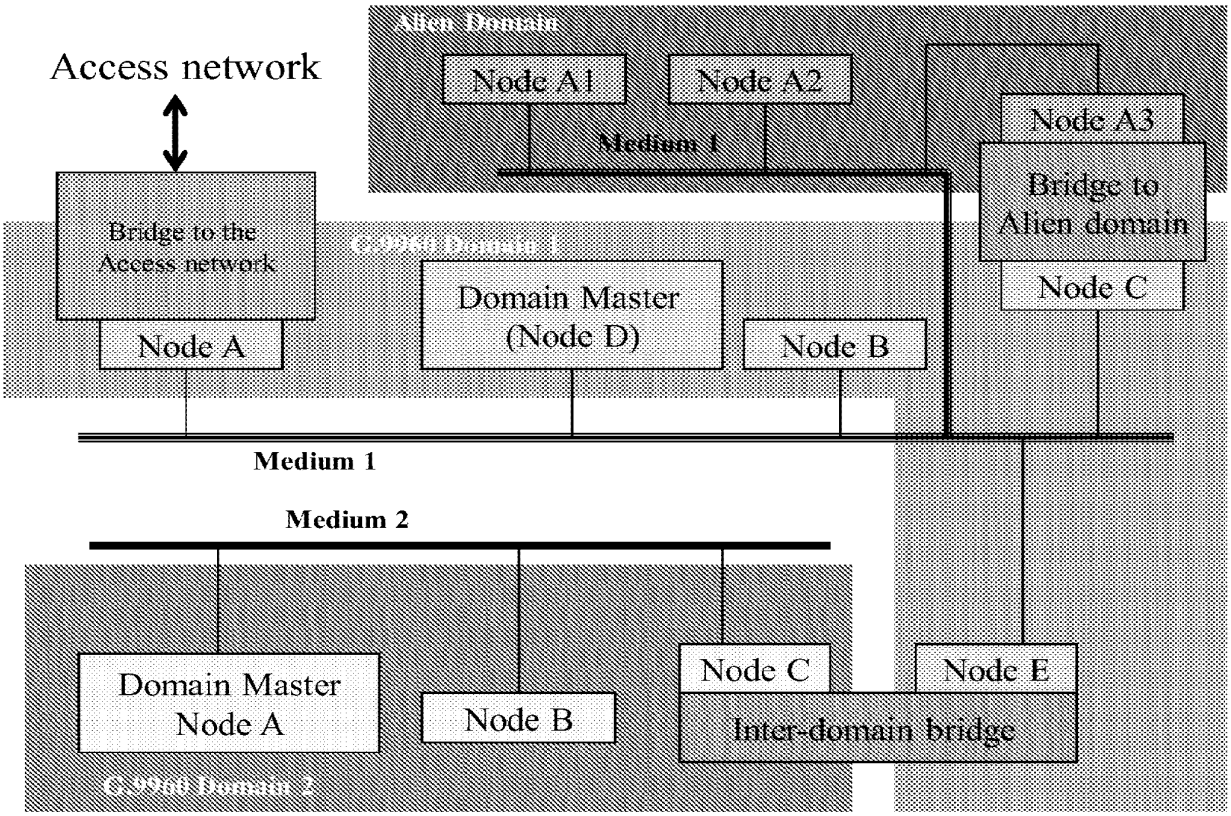
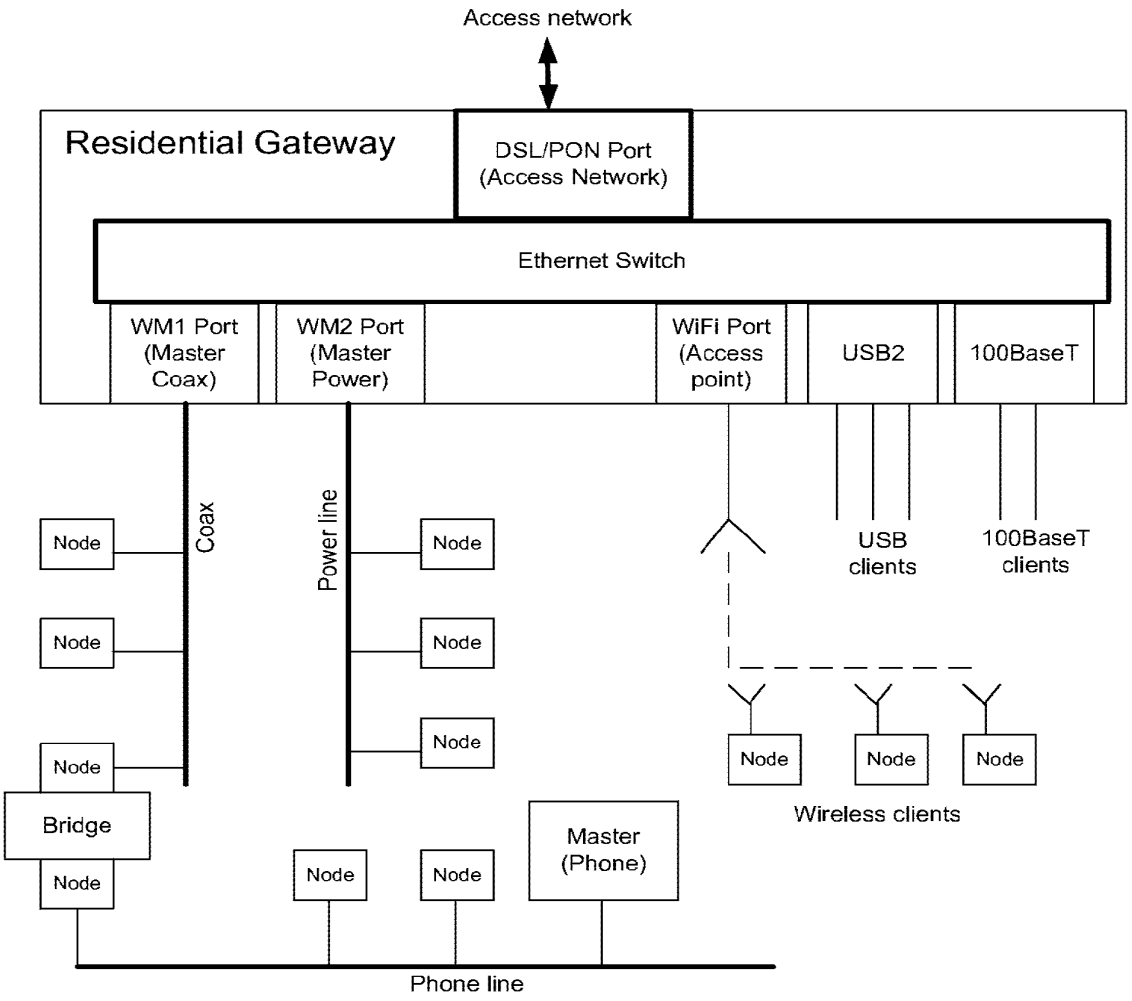


Figure II-4/G.9960 – Example of HN sharing medium with an Alien Domain

An example of HN as a part of residential broadband access is presented in Figure II-5. In the example, home network includes three domains established over coax, phone, and power line wiring. Alien domains of the network are established by the Residential Gateway and may include WLAN IEEE 802.11, USB2, and IEEE 802.3 (Ethernet). RG serves as a bridge allowing communication with Alien domains (e.g., 802.11) and with Access Network (e.g. PON or DSL).

Each HN node in Figure II-5 is configured for the medium it is connected to. It can communicate with any other HN node of the same domain using either PP or CTR type of communication. Communication between HN nodes of different HN domains (e.g., between coax and phone line in Figure II-5) is via inter-domain bridges or via the RG. Communication with the nodes of Alien domains and with Access network is via bridges which are a part of RG.



2293

2294 **Figure II-5/G.9960 – Example of HN supporting residential broadband access**

2295
2296

Appendix III: Spectral usage

III.1 Scope

This appendix describes information on spectral usage on each medium (coax cable, phone line and power line).

III.2 Spectral usage in Japan

III.2.1 Frequency allocation for coax

There are mainly three types of services which are mapped to in-home coax medium:

- Terrestrial broadcasting
- Satellite broadcastings
- CATV services

The frequency allocations for all cases are shown in this clause.

It should be noted that coaxial home network connected to cable access network should not interfere the services offered by the cable television operator to customers. The general use of the frequency by the cable television operator is 5 to 770MHz.

III.2.1.1 Terrestrial broadcast signal mapped to coax cable

Table III-1 shows the frequency allocation for terrestrial TV broadcasting mapped to coax cable. Currently, both analog TV broadcasting (VHF/UHF) and digital TV broadcasting (UHF) are in service [1]. But analog TV broadcasting services will be discontinued on 24th July 2011 [2][3] and non-TV broadcasting and other telecommunications are planned to use these bands after that. G.9960 is one of the candidate services for empty bands if available, but this is for further study.

Table III-1/G.9960 – Frequency allocation for terrestrial broadcast signals mapped to a coax cable

	Frequency [MHz]	Remarks
	90 – 108 *	• Used for analog TV broadcasting till 24th July 2011 • The use after 25th July 2011 is not determined at the time of publication • Retransmission of terrestrial digital TV broadcasting (OFDM)
	108 – 170 *	• Retransmission of terrestrial digital TV broadcasting (OFDM)
	170 – 222 *	• Used for analog TV broadcasting till 24th July 2011 • The use after 25th July 2011 is not determined at the time of publication • Retransmission of terrestrial digital TV broadcasting (OFDM)
	222 – 470 *	• Retransmission of terrestrial digital TV broadcasting (OFDM)
	470 – 710 *	• Used for analog TV broadcasting till 24th July 2011 • Used for digital TV broadcasting • Retransmission of terrestrial digital TV broadcasting (OFDM)
	710 – 770 *	• Used for TV broadcasting till 24th July 2012 • The use after 25th July 2012 is not determined at the time of publication • Retransmission of terrestrial digital TV broadcasting (OFDM)
*	Frequency band usage for G.9960 including guard band is for further study.	

III.2.1.2 Broadcast Satellite (BS) and Communication Satellite (CS) signal mapped to coax cable

Satellite broadcastings (BS and CS) using around 12 GHz of frequency [1] are down-converted to intermediate frequency (BS-IF/CS-IF) at an antenna before transmission to a coax cable. The BS and CS need dedicated receiver antennas and there are various cases to use in-home coax cables depending on locations of antennas and connection points to in-home coax system. Basically, BS-IF/CS-IF signals come from an antenna or CATV. Table III-2 shows satellite broadcast signals mapped to a coax cable.

Table III-2/G.9960 – Frequency allocation for satellite broadcast signals mapped to a coax cable

Broadcast satellite services	BS-IF/CS-IF [MHz]	Remarks
BS *	1035.95 – 1331.50	BS-IF transmission
110° CS *	1596 – 2070	CS-IF transmission
JC SAT-3,4 *	968 – 2055	CS-IF transmission
Superbird C *	1020 – 2040	CS-IF transmission
* Frequency band usage for G.9960 including guard band is for further study.		

III.2.1.3 CATV services on coax cable

Table III-3 shows the frequency allocation of other services [4][5]. Since frequencies below 770MHz are currently used for various services listed in Table III-3, the usage for other services such as G.9960 is for further study.

2342 **Table III-3/G.9960 – Frequency allocation of other services on coax cable**

Frequency [MHz]	Usage	Remarks
5 – 60 *	• Upstream CATV signal (cable internet signal, VoIP, VOD, relay broadcast, pilot signal etc.)	• Being used for Cable Modem(CM) up-stream signals [6][7][8] • Being used for control signals between CM and Cable Modem Termination
70 – 76 *	• Downstream pilot signal, analog HT (Home Terminal) control signal, monitoring signal of amplifier	• Being used for Cable Modem(CM) up-stream signals [6][7][8]
76 – 90 *	• Retransmission of radio broadcasting on cable (FM radio signal)	• Being used for Cable Modem(CM) up-stream signals [8]
90 – 770 *	• Analog cable broadcasting (NTSC-VSB) • Digital cable broadcasting (64/256QAM) • Retransmission of terrestrial analogTV broadcasting (NTSC-VSB) • Retransmission of terrestrial digitall TV broadcasting (OFDM) • Downstream cable internet signal, VoIP, VOD control signal etc.	• Covered by regulation [4]
770 – 1035 **	• Other home network services	
1035 – 2070 *	• BS-IF/CS-IF retransmission	
>2070 **	• Currently not in use at the time of publication	
* Frequency band usage for G.9960 including guard band is for further study. ** Candidate frequency band for G.9960 including guard band.		

2343

2344 **III.2.2 Frequency allocation for phone line**

2345 (For further study)

2346

2347 **III.2.3 Frequency allocation for power line**

2348 (For further study)

2349 **III.2.4 Bibliography**

2350 [1] Spectrum Charts, Ministry of Internal Affairs and Communications,
2351 http://www.tele.soumu.go.jp/e/search/myuse/use0303/index.htm

[2] Schedule, Ministry of Internal Affairs and Communications, http://www.soumu.go.jp/joho_tsusin/whatsnew/digital-broad/when_en.html

[3] Announcement of channel plan for terrestrial digital TV broadcasting, Ministry of Internal Affairs and Communications (Japanese), http://www.soumu.go.jp/s-news/2008/080331_11.html

[4] Cable Television Broadcast Law (Japanese), http://law.e-gov.go.jp/htmldata/S47/S47F04001000040.html

[5] STD-013-2.0, "Transmission System for MDU", Japan Cable Television Engineering Association (JCTEA) (Japanese), http://www.catv.or.jp/jctea/

[6] ITU-T Rec.J.112 "Transmission systems for interactive cable television services"

[7] ITU-T Rec.J.122 "Second-generation transmission systems for interactive cable television services – IP cable modems"

[8] ITU-T Rec. J.222.1 "Third-generation transmission systems for interactive cable television services – IP cable modems: Physical layer specification"

2368

2369 **Appendix IV - Priority Mapping**

2370

2371 Priority mapping recommended by IEEE 802.1D (sub-clause 7.7.3) are presented in Table IV-1.

2372

2373 **Table IV-1: Recommended Flow Priority to Priority Queue Mappings according to 802.1D**

		Number of Available Traffic Classes							
		1	2	3	4	5	6	7	8
User Priority	0 (default)	0	0	0	1	1	1	1	2
	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	1
	3	0	0	0	1	1	2	2	3
	4	0	1	1	2	2	3	3	4
	5	0	1	1	2	3	4	4	5
	6	0	1	2	3	4	5	5	6
	7	0	1	2	3	4	5	6	7

2374

2375

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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
13/376,856	Joon Bae KIM	5550-87-PUS

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INTERNATIONAL APPLICATION NO.	
PCT/US10/46088	
I.A. FILING DATE	PRIORITY DATE

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371 FORMALITIES LETTER

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Date Mailed: 12/27/2011

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated Office (37 CFR 1.494):

- Copy of the International Application filed on 12/08/2011
- Copy of the International Search Report filed on 12/08/2011
- Preliminary Amendments filed on 12/08/2011
- U.S. Basic National Fees filed on 12/08/2011
- Assignee Statement for PGPUB filed on 12/08/2011
- Priority Documents filed on 12/08/2011

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

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VALERIE A JACKSON

Telephone: (703) 756-1443

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/376,856

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	490
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	22 minus 20 =	* 2			OR	x 60 =	120
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 250 =	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	1240

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	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.

PTO-1390 (09-11)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
5550-87-PUS	13/376,856

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US2010/046088	20 AUGUST 2010 (20.08.2010)	21 AUGUST 2009 (21.08.2009)

TITLE OF INVENTION
HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

APPLICANT(S) FOR DO/EO/US
Joon Bae KIM and Marcos C. TZANNES

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☐ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☑ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected (Article 31).
5. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☑ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A preliminary amendment.
14. ☐ An Application Data Sheet under 37 CFR 1.76.
15. ☐ A substitute specification.
16. ☐ A power of attorney and/or change of address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821- 1.825.
18. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

This collection of information is required by 37 CFR 1.414 and 1.491-1 .492. The information is required to obtain or retain a b enefit by the public, w hich is to file (and by the USPTO to pro cess) 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 15 minutes to complete, including gathering information, preparing, and submitting the completed 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 FEE S OR COMPLE TED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
13/376,856	PCT/US2010/046088	5550-87-PUS

20. Other items or information:

The following fees have been submitted	CALCULATIONS	PTO USE ONLY
21. ☐ Basic national fee (37 CFR 1.492(a)) **$380**	$	
22. ☐ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** All other situations **$250**	$	
23. ☐ Search fee (37 CFR 1.492(b)) If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ..... **$120** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB ..... **$490** All other situations **$620**	$	
TOTAL OF 21, 22 and 23 =		

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)).
The fee is **$310** for each additional 50 sheets of paper or fraction thereof.

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round **up** to a whole number)	RATE	
- 100 =	/50 =		x $310	$

Surcharge of **$130.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	- 20 =		x $ **60**	$	
Independent claims	- 3 =		x **$250**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$450**	$	
			TOTAL OF ABOVE CALCULATIONS =	$0	
☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by ½.					
			SUBTOTAL =	$ 0	
Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). +				$	
			TOTAL NATIONAL FEE =	$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
			TOTAL FEES ENCLOSED =	$ 0	
			Amount to be refunded:	$	
			Amount to be charged	$0	

a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees.

c. ☑ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-1970.

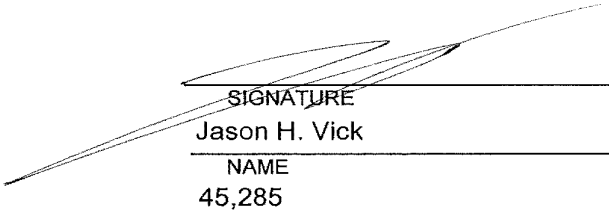
d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended paying fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

SHERIDAN ROSS P.C.
1560 Broadway
Suite 1200
Denver, Colorado 80202
UNITED STATES



SIGNATURE

Jason H. Vick

NAME

45,285

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.

Doc Code: Oath
Document Description: Oath or declaration filed

PTO/SB/01 (04-09)
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☐ Declaration Submitted With Initial Filing OR ☒ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)

Attorney Docket Number	5550-87-PUS
First Named Inventor	KIM
COMPLETE IF KNOWN	
Application Number	13/376,856
Filing Date	December 8, 2011
Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

(Title of the Invention)

the application of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 08/20/2010 as United States Application Number or PCT International Application Number PCT/US10/46088 and was amended on (MM/DD/YYYY) 12/08/2011 (if applicable).

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

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 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.

Authorization To Permit Access To Application by Participating Offices

☐ If 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 World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 21 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.

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to:	☒	The address associated with Customer Number:	62574	OR ☐	Correspondence address below

Name		
Address		
City	State	Zip
Country	Telephone	Email

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. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE, COMMERCE-PAT-7, System name: *Patent Application Files*. Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: *Deposit Accounts and Electronic Funds Transfer Profiles*.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any])	Family Name or Surname
Joon Bae	KIM
Inventor's Signature	Date
Joon Bae Kim	Jan 3 '12

Residence: City	State	Country	Citizenship
Lexington	MA	US	KR

Mailing Address			
14 Pine Knoll Road			
City	State	Zip	Country
Lexington	MA	02420	US

☒ Additional inventors or a legal representative are being named on the one supplemental sheet(s) PTO/SB/02A or 02LR attached hereto

PTO/SB/02A (07-07)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor		
Given Name (first and middle (if any))	Family Name or Surname		
Marcos C.	TZANNES		
Inventor's Signature			Date Feb 2, 2012
Orinda Residence: City	CA State	US Country	US Citizenship
121 La Espiral Mailing Address			
Orinda City	CA State	94563 Zip	US Country

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor		
Given Name (first and middle (if any))	Family Name or Surname		
Inventor's Signature			Date
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor		
Given Name (first and middle (if any))	Family Name or Surname		
Inventor's Signature			Date
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

This collection of information is required by 35 U.S.C. 116 and 37 CFR 1.63. 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 21 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 (1-800-786-9199) and select option 2.

Privacy Act Statement

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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.

Electronic Acknowledgement Receipt

EFS ID:	12024178
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae KIM
Customer Number:	62574
Filer:	Jason Vick/Yvonne Carter
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	08-FEB-2012
Filing Date:	
Time Stamp:	09:04:30
Application Type:	U.S. National Stage under 35 USC 371

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	Documents submitted with 371 Applications	371_Transmittal_2_FINAL.pdf	497688 d8ba31282c837e38571fd0ce80adb4436c2af41c	no	4

Warnings:	
Information:	

2	Oath or Declaration filed	Declaration_FINAL.pdf	536839 29caaa48c9b1b51983ca4802fa7b8048b1eb44c6	no	4

Warnings:	
Information:	
Total Files Size (in bytes):	1034527

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.

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

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
13/376,856	Joon Bae Kim	5550-87-PUS

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

INTERNATIONAL APPLICATION NO.	
PCT/US10/46088	
I.A. FILING DATE	PRIORITY DATE
08/20/2010	08/21/2009

CONFIRMATION NO. 7171
371 ACCEPTANCE LETTER



Date Mailed: 03/29/2012

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

02/08/2012	02/21/2012
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Copy of the International Application filed on 12/08/2011
- Copy of the International Search Report filed on 12/08/2011
- Preliminary Amendments filed on 12/08/2011
- Oath or Declaration filed on 02/08/2012
- U.S. Basic National Fees filed on 12/08/2011
- Assignee Statement for PGPUB filed on 12/08/2011
- Priority Documents filed on 12/08/2011

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

VALERIE A JACKSON

Telephone: (703) 756-1443

FORM PCT/DO/EO/903 (371 Acceptance Notice)

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
13/376,856	02/08/2012		1240	5550-87-PUS	22	3

CONFIRMATION NO. 7171

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

FILING RECEIPT

OC000000053336541

Date Mailed: 03/29/2012

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**

Applicant(s)

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

Assignment For Published Patent Application

AWARE, INC., Bedford, MA

Power of Attorney: The patent practitioners associated with Customer Number 62574

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/US10/46088 08/20/2010
which claims benefit of 61/235,909 08/21/2009

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 03/23/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/376,856**

Projected Publication Date: 07/05/2012

Non-Publication Request: No

Early Publication Request: No

Title

HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

Preliminary Class

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 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 (1-866-999-4158).

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 AssetsControl, 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).

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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, facilitate, and accelerate 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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/376,856

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	490
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	22 minus 20 =	* 2			OR	x 60 =	120
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 250 =	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	1240

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	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.

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2611
				Examiner Name	
Sheet	1	of	2	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	1	EP 1392025	02-25-2004	Kabushiki Kaisha Toyota Jidoshokki Kariya-Shi		
	2	WO 2007/127311	11-08-2007	Interdigital Technology Corporation		

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
	3	"IEEE 802.11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications" June 2007; 1233 pages
	4	"IEEE 802.3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications" December 2008; 2977 pages
	5	"IEEE 802.16: Air Interface for Fixed Broadband Wireless Access Systems" October 2004; 895 pages.
	6	"ITU G.9960: Unified High-Speed Wire-Line Based Home Networking Transceivers - Foundation" October 2009; 112 pages
	7	"ITU Standard G.997.1: Physical Layer Management for Digital Subscriber Line (DSL) Transceivers" April 2009; 128 pages
	8	Editor for G.9960, "ITU-T Recommendation G.9960: Next generation wire-line based home networking transceivers – Foundation," ITU-T SG15/Q4, Jan. 2009.

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2611
				Examiner Name	
Sheet	2	of	2	Attorney Docket Number	5550-87-PUS

	9	Aware, Inc., "G.hn: PHY-Frame Header Extension," ITU-T SG15/Q4 09CC-046, Concord, California, Aug. 2009
	10	CopperGate Communications, "G.hn: Using Two Symbols for the Header of a PHY frame on Coax," ITU-T SG15/Q4 09XC-100, Xian, China, Jul. 2009.
	11	Intellon, Corporation, "G.hn: Extended PHY frame header," ITU-T SG15/Q4 09XC-119, Xian, China, Jul. 2009
	12	OKSMAN, et al. "G.hn: The New ITU-T Home Networking Standard" IEEE Communications Magazine, IEEE Service Center, Piscataway, US, Vol 47, No. 10, October 1, 2009, pages 138-145 XP011283328
	13	International Search Report for International (PCT) Application No. PCT/US2010/046088, mailed Dec. 22, 2010 (Attorney Ref. No.: 5550-87-PCT)
	14	Written Opinion for International (PCT) Application No. PCT/US2010/046088, mailed Dec. 22, 2010 (Attorney Ref. No.: 5550-87-PCT)
	15	International Preliminary Report on Patentability for International (PCT) Application No. PCT/US2010/046088, mailed March 1, 2012 (Attorney Ref. No.: 5550-87-PCT)
	16	Communication Pursuant to Rules 161(1) and 162 EPC for European Patent Application No. 10748023.8, mailed April 18, 2012 (Attorney Ref. No.: 5550-87-PEP)

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Acknowledgement Receipt

EFS ID:	12843571
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	23-MAY-2012
Filing Date:	08-FEB-2012
Time Stamp:	11:45:46
Application Type:	U.S. National Stage under 35 USC 371

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		IDS_01.pdf	455656 f4756045b83f2539b0b8849aead185659509bfc3	yes	5

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	5	
Warnings:					
Information:					
2	Foreign Reference	EP1392025.pdf	955419 7fdd1d0848d1f48809a14ef8289829d07e2a00ec	no	23
Warnings:					
Information:					
3	Foreign Reference	WO2007127311.pdf	1010429 8d3cbf848f60b81005690ca6f24b7fad6845e4ab	no	26
Warnings:					
Information:					
4	Non Patent Literature	IEEE_Standard_802-11_June_2007.pdf	14782595 b9bf12e06cbd43bdea6072759a9a6ccb4daca03b	no	1233
Warnings:					
Information:					
5	Non Patent Literature	IEEE_Standard_802-3_Dec_2008.pdf	13139221 2a0c4572203d5822ecc0092264f3a8d9374325c4	no	2977
Warnings:					
Information:					
6	Non Patent Literature	IEEE_Standard_802-16_Oct_2004_pps_1-599.pdf	23683231 17f90388f2acfc4f7ce3c57619c869c090be0193	no	599
Warnings:					
Information:					
7	Non Patent Literature	IEEE_Standard_802-16_Oct_2004_pp_600-895.pdf	11894824 b89fccacc7c57fc2eed52a99422763c6c05dfb95	no	296
Warnings:					
Information:					
8	Non Patent Literature	ITU-T_Recommendation_G-9960_10-2009.pdf	1380440 1b4aa99ff2ccfd7092cbce6d7fda8e686a0ceebd	no	112
Warnings:					
Information:					

9	Non Patent Literature	ITU-T_Recommendation_G997-1_04-2009.pdf	6552230 2bae577eae5cc75895909d07b133cc694fbfa633	no	128
Warnings:					
Information:					
10	Non Patent Literature	Editor_G_9960_Next_Generation_Jan_2009.pdf	973399 3fd4423ac00e96b526aad0294752a32859091233	no	106
Warnings:					
Information:					
11	Non Patent Literature	Aware_Ghn_PHY_Frame_Header_Extension_Aug_2009.pdf	90598 f3399e07d4788692c87c45e686e9b3e833f98245	no	7
Warnings:					
Information:					
12	Non Patent Literature	Coppergate_Ghn_Using_2_Symbols_July_2009.pdf	59225 0aad728b741dee9a658c97ce0dbecf86e49c9e00	no	3
Warnings:					
Information:					
13	Non Patent Literature	Intellon_Ghn_Extended_PHY_Frame_Header_July_2009.pdf	74802 b452a9e685b7fd1a0e1347cb7c84d0cef488a3b9	no	4
Warnings:					
Information:					
14	Non Patent Literature	Oksman_Ghn_The_New_ITU-T_Home_Networking_Standard.pdf	1602866 bb850758afc49561f4fce83a1ba20644db9b1d3a	no	8
Warnings:					
Information:					
15	Non Patent Literature	5550-87-PCT_ISR_12-22-2010.pdf	657593 86c2e09412e59f92a1aeb85022fb17d99a9e9274	no	7
Warnings:					
Information:					
16	Non Patent Literature	5550-87-PCT_WO_12-22-2010.pdf	848629 dafc015ea04eae43d8d0efc523f3188b0c4a332b	no	9
Warnings:					
Information:					
17	Non Patent Literature	5550-87-PCT_IPRP_03-01-2012.pdf	420547 1d7e536aed43af7c289074350cdb5ef65f70bc4b	no	9
Warnings:					
Information:					

18	Non Patent Literature	5550-87-PEP_OA_04-18-2012.pdf	102910 8587a647457e0f1314f8e7bf5ad3622f01bc7330	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	78684614

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:	)	Group Art Unit: 2611
Joon Bae Kim et al.	)	Confirmation No.: 7171
Serial No.: 13/376,856	)	Examiner:
Filed: February 8, 2012	)	
Atty. File No.: 5550-87-PUS	)	INFORMATION DISCLOSURE STATEMENT
Entitled: "HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS"	)	Electronically Submitted

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

Dear Sir:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

☒ Copies of the cited non-patent and/or foreign references are enclosed herewith.

☐ Copies of the cited U.S. patents and/or patent applications are enclosed herewith.

☒ Copies of the cited U.S. patents/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).

☐ Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. _____ filed _____, which is relied upon for an earlier filing date under 35 U.S.C. § 120.

☐ To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English translation/abstracts and/or in the figures, although applicants do not necessarily vouch for the accuracy of the translation.

☐ Examiner's attention is drawn to the following related applications:

- Serial No. _____ filed _____(Attorney Ref. No. _____)

☐ Other:_____

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented.

Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

FEES

☒	**37 CFR 1.97(b)**: No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction): ☐ Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or ☐ Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or ☒ Before the mailing date of a first Office Action on the merits, or ☐ Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114. Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.
☐	**37 CFR 1.97(c)**: The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions: (1) a final action under 37 C.F.R. 1.113 or (2) a notice of allowance under 37 C.F.R. 1.311, or (3) an action that otherwise closes prosecution in the application. This Information Disclosure Statement is accompanied by: ☐ A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970. OR ☐ Please charge Deposit Account 19-1970 in the amount of $180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.
☐	**37 CFR 1.97(d)**: This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c). ☐ This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e) AND ☐ Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of $180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.

Certification (37 C.F.R. 1.97(e))
(Applicable only if checked)

☐ The undersigned certifies that:

☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(1).

☐ A copy of the communication from the foreign patent office is enclosed.

OR

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

SHERIDAN ROSS P.C.

By: _____

Jason H. Vick
Registration No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202-5141
(303) 863-9700

Date: 23 MAY '12

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/376,856	02/08/2012	Joon Bae Kim	5550-87-PUS

CONFIRMATION NO. 7171

PUBLICATION NOTICE

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

OC000000055202083

Title:HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

Publication No.US-2012-0170625-A1
Publication Date:07/05/2012

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 publically 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 Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, 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 http://pair.uspto.gov/. 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 Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2633
				Examiner Name	Ali, Shawkat M.
Sheet	1	of	1	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] (if known)	Filing Date MM-DD-YYYY	Name of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
	1	Official Action (including translation) for Chinese Patent Application No. 201080037081.2, mailed December 4, 2013 (Attorney Ref. No.: 5550-87-PCN)

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Acknowledgement Receipt

EFS ID:	18242430
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	19-FEB-2014
Filing Date:	08-FEB-2012
Time Stamp:	15:42:03
Application Type:	U.S. National Stage under 35 USC 371

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		IDS_02.pdf	522254 c4f3b7fc86180f77fb57a74496b55ec1a67f6a08	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Form (SB08)	4	4

Warnings:					
Information:					
2	Non Patent Literature	5550-87-PCN_OA_12-04-2013.pdf	216234 345fe001bd81e466aa1afef97dc7159c2b324908	no	8
Warnings:					
Information:					
		Total Files Size (in bytes):	738488		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim Serial No.: 13/376,856 Filed: February 8, 2012 Atty. File No.: 5550-87-PUS Entitled: "HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS"	Group Art Unit: 2633 Confirmation No.: 7171 Examiner: Ali, Shawkat M. SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT Electronically Submitted

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

Dear Sir:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

☒ Copies of the cited non-patent and/or foreign references are enclosed herewith.

☐ Copies of the cited U.S. patents and/or patent applications are enclosed herewith.

☐ Copies of the cited U.S. patents/unpublished patent applications/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).

☐ Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. _____ filed _____, which is relied upon for an earlier filing date under 35 U.S.C. § 120.

☒ To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English translation/abstracts and/or in the figures, although applicants do not necessarily vouch for the accuracy of the translation.

☐ Examiner's attention is drawn to the following related applications:

- Serial No. _____ filed _____(Attorney Ref. No. _____)

☐ Other:_____

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented.

Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

FEES

☒	**37 CFR 1.97(b)**: No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction): ☐ Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or ☐ Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or ☒ Before the mailing date of a first Office Action on the merits, or ☐ Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114. Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.
☐	**37 CFR 1.97(c)**: The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions: (1) a final action under 37 C.F.R. 1.113 or (2) a notice of allowance under 37 C.F.R. 1.311, or (3) an action that otherwise closes prosecution in the application. This Information Disclosure Statement is accompanied by: ☐ A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970. OR ☐ Please charge Deposit Account 19-1970 in the amount of $180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.
☐	**37 CFR 1.97(d)**: This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c). ☐ This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e) AND ☐ Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of $180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.

Certification (37 C.F.R. 1.97(e))
(Applicable only if checked)

☐ The undersigned certifies that:

☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(1).

☐ A copy of the communication from the foreign patent office is enclosed.

OR

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

SHERIDAN ROSS P.C.

By: _____

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Registration No. 45,285
1560 Broadway, Suite 1200
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(303) 863-9700

Date: 19 Feb '14

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	5550-87-PUS	7171

62574 7590 06/17/2014

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

NOTIFICATION DATE	DELIVERY MODE
06/17/2014	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):

jvick@sheridanross.com

Office Action Summary	Application No. 13/376,856	Applicant(s) KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12/08/2011*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,5,10,11,16,19,24,29,30,35,38,42,47,48,53,56 and 60-65* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,5,10,11,16,19,24,29,30,35,38,42,47,48,53,56 and 60-65* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *12/08/2011* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ 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)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement (IDS)

2. The IDSs submitted on 05/23/2012 and 02/19/2014 have been entered and considered by the Examiner.

Claim Objections

3. Claim 1 (19 and 38) is objected to because the acronym "OFDM" should be spelled out the first time it is used in the claim. Similar objection is applied to claim 60 (62) for not defining the "ASIC". In addition, claim 10 (29 and 47) recites "wherein a header" rather it should have been "wherein the header". Furthermore, claim 56 should have been in an independent form since it is claiming as a computer-readable storage. Appropriate corrections are required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 19 and 38 are rejected under 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. The expressions "header OFDM symbol" or "OFDM header symbol" (e.g. lines 4 and 7 of claim 1) used in the description and throughout the claims are not clear. As generally accepted in the art

an OFDM symbol is defined by the fixed number of sub-carriers available for the actual transmission channel. The relationship between OFDM i.e. the number of sub-carriers and the number of header bits is not clear. Hence, the expressions "header OFDM symbol" or "OFDM header symbol" render the claims 1, 19, 38 and their dependent claims indefinite.

Furthermore, claims 1, 19, 38 and their dependent claims are rejected under 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. The expressions "header bits using D header OFDM symbols" (e.g. lines 6 and 7 of claim 1) recited in the present application indicates that "header bits" comprise "D header OFDM symbols" while "each OFDM header symbol carries the plurality of header bits" (e.g. line 7 of claim 1) indicates that each of "header OFDM symbols" comprises multiple "header bits". The two expressions contradict with each other so that the person skilled in the art cannot determine the relation between "header bits" and "header OFDM symbols". Therefore, the person skilled in the art cannot carry out the invention according to the disclosure of the present application. These claims will be examined as best understood by the Examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 5, 10, 11, 16, 19, 24, 29, 30, 35, 38, 42, 47, 48, 53, 56 and 60-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gu (US 2009/0290563 A1).

Regarding claim 1. Gu discloses an OFDM communication method comprising: transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor (**Figures 5A & 5C, Paragraphs 51 & 123**), and transmitting or receiving a second frame having a plurality of header bits using D header OFDM symbols, (**Abstract, Figures 5A & 5C, Paragraphs 51 & 123**). However, Gu does not explicitly teach wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of header OFDM symbols that carry header bits and wherein each OFDM header symbol carries the plurality of header bits; yet, from the disclosure of Gu, in particular claim 3, "each TXOP defined by the media access layer protocol", one skilled in the art would have implemented said TXOP defined by the MAC to be header OFDM symbols, as said TXOP defined by the MAC can simply be selected based on its system advantages and disadvantages. Therefore, it would have been obvious to one skilled in the art to choose the D according to the circumstances.

Regarding claims 19 & 38. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 1 due to the similar scope.

Regarding claim 5. Gu further discloses modulating the header bits onto the D OFDM symbols,

wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols (**Figures 5A & 5C, Paragraphs 62-63**).

Regarding claims 24 & 42. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 5 due to the similar scope.

Regarding claim 10. Gu also discloses wherein a header of the second frame comprises a bit field that indicates the value for D (**Figure 5C, Claim 3**).

Regarding claims 29 & 47. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 10 due to the similar scope.

Regarding claim 11. Gu also discloses wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value of D (**Figure 5C, Claim 3**).

Regarding claims 30 & 48. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 11 due to the similar scope.

Regarding claim 16. Gu also discloses wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2 (**Figure 5C, Claim 3**).

Regarding claims 35 & 53. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 16 due to the similar scope.

Regarding claim 56. Gu also discloses a non-transitory computer-readable information storage media having processor-executable instructions stored thereon that, if executed by a processor, are capable of performing the steps in claim 1 (**Figures 5A & 5C, Paragraph 22**).

Regarding claim 60. Gu also discloses wherein the transmitting or receiving is performed by a transceiver including an ASIC (**Figures 5A & 5C, Paragraph 22**).

Regarding claims 62 & 64. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 60 due to the similar scope.

Regarding claim 61. Gu also discloses wherein the transmitting or receiving is performed by a transceiver including a digital signal processor (**Figures 5A & 5C, Paragraph 22**).

Regarding claims 63 & 65. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 61 due to the similar scope.

Conclusions

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHAWKAT M. ALI whose telephone number is (571) 270-1639. The examiner can normally be reached on Monday-Thursday 8:00AM-4:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, SAM K. AHN can be reached on (571) 272-3044. 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.

/SHAWKAT M ALI/

Examiner, Art Unit 2633

/JAISON JOSEPH/

Primary Examiner, Art Unit 2633

Notice of References Cited	Application/Control No. 13/376,856	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2009/0290563	11-2009	Gu et al.	370/338
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	06/05/2014							
	1	✓								
	2	-								
	3	-								
	4	-								
	5	✓								
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	7	-								
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	29	✓								
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	31	-								
	32	-								
	33	-								
	34	-								
	35	✓								
	36	-								

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	13376856	KIM ET AL.
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	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	06/05/2014							
	37	-								
	38	✓								
	39	-								
	40	-								
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	42	✓								
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	64	✓								
	65	✓								

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2611
				Examiner Name	
Sheet	1	of	2	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
/S.A./	1	EP 1392025	02-25-2004	Kabushiki Kaisha Toyota Jidoshokki Kariya-Shi		
/S.A./	2	WO 2007/127311	11-08-2007	Interdigital Technology Corporation		

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
/S.A./	3	"IEEE 802.11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications" June 2007; 1233 pages
/S.A./	4	"IEEE 802.3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications" December 2008; 2977 pages
/S.A./	5	"IEEE 802.16: Air Interface for Fixed Broadband Wireless Access Systems" October 2004; 895 pages.
/S.A./	6	"ITU G.9960: Unified High-Speed Wire-Line Based Home Networking Transceivers - Foundation" October 2009; 112 pages
/S.A./	7	"ITU Standard G.997.1: Physical Layer Management for Digital Subscriber Line (DSL) Transceivers" April 2009; 128 pages
/S.A./	8	Editor for G.9960, "ITU-T Recommendation G.9960: Next generation wire-line based home networking transceivers – Foundation," ITU-T SG15/Q4, Jan. 2009.

Examiner Signature	/Shawkat Ali/	Date Considered	06/05/2014

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2611
				Examiner Name	
Sheet	2	of	2	Attorney Docket Number	5550-87-PUS

/S.A./	9	Aware, Inc., "G.hn: PHY-Frame Header Extension," ITU-T SG15/Q4 09CC-046, Concord, California, Aug. 2009
/S.A./	10	CopperGate Communications, "G.hn: Using Two Symbols for the Header of a PHY frame on Coax," ITU-T SG15/Q4 09XC-100, Xian, China, Jul. 2009.
/S.A./	11	Intellon, Corporation, "G.hn: Extended PHY frame header," ITU-T SG15/Q4 09XC-119, Xian, China, Jul. 2009
/S.A./	12	OKSMAN, et al. "G.hn: The New ITU-T Home Networking Standard" IEEE Communications Magazine, IEEE Service Center, Piscataway, US, Vol 47, No. 10, October 1, 2009, pages 138-145 XP011283328
/S.A./	13	International Search Report for International (PCT) Application No. PCT/US2010/046088, mailed Dec. 22, 2010 (Attorney Ref. No.: 5550-87-PCT)
/S.A./	14	Written Opinion for International (PCT) Application No. PCT/US2010/046088, mailed Dec. 22, 2010 (Attorney Ref. No.: 5550-87-PCT)
/S.A./	15	International Preliminary Report on Patentability for International (PCT) Application No. PCT/US2010/046088, mailed March 1, 2012 (Attorney Ref. No.: 5550-87-PCT)
/S.A./	16	Communication Pursuant to Rules 161(1) and 162 EPC for European Patent Application No. 10748023.8, mailed April 18, 2012 (Attorney Ref. No.: 5550-87-PEP)

Examiner Signature	/Shawkat Ali/	Date Considered	06/05/2014

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BIB DATA SHEET

CONFIRMATION NO. 7171

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/376,856	02/08/2012	375	2633	5550-87-PUS

APPLICANTS

INVENTORS

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/US10/46088 08/20/2010
which claims benefit of 61/235,909 08/21/2009

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

03/23/2012

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No		MA	8	22	3
Verified and Acknowledged	/SHAWKAT M ALI/ Examiner's Signature	Initials				

ADDRESS

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202
UNITED STATES

TITLE

HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

FILING FEE RECEIVED		
1240	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	(13/376856).APP.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/06/06 10:59
S2	2601	((Joon) near2 (Kim)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:11
S3	237	((Marcos) near2 (Tzannes)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:12
S4	2832	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:12
S5	3	S4 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:13
S6	28058	(370/338,356,458,468).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S7	16810	(375/219,260).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S8	44525	S6 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S9	158	S8 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S10	80	S8 and "OFDM" and ("TXOP" same ("MAC" "MAP"))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52
S11	45	S10 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52

EAST Search History (Interference)

<This search history is empty>

6/11/2014 2:40:12 PM
C:\Users\sali\Documents\EAST\Workspaces\Case_116_JK_13376856.wsp

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2633
				Examiner Name	Ali, Shawkat M.
Sheet	1	of	1	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] (if known)	Filing Date MM-DD-YYYY	Name of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
/S.A./	1	Official Action (including translation) for Chinese Patent Application No. 201080037081.2, mailed December 4, 2013 (Attorney Ref. No.: 5550-87-PCN)

Examiner Signature	/Shawkat Ali/	Date Considered	06/05/2014

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2633
				Examiner Name	Ali, Shawkat M.
Sheet	1	of	1	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] (if known)	Filing Date MM-DD-YYYY	Name of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
	1	Official Action (including translation) for Chinese Patent Application No. 201080037081.2, mailed July 3, 2014 (Attorney Ref. No.: 5550-87-PCN)

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Acknowledgement Receipt

EFS ID:	20103254
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	10-SEP-2014
Filing Date:	08-FEB-2012
Time Stamp:	17:20:04
Application Type:	U.S. National Stage under 35 USC 371

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		IDS_03.pdf	524677 5f71e53b07857ef852a9e50bf6f33a3376a1262a	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Form (SB08)	4	4

Warnings:					
Information:					
2	Non Patent Literature	5550-87-PCN_OA_07-03-2014.pdf	808348 f26adb1429739b5ecf193e8297fb99741613db2b	no	12
Warnings:					
Information:					
		Total Files Size (in bytes):	1333025		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:	)	Group Art Unit: 2633
Joon Bae Kim	)	Confirmation No.: 7171
Serial No.: 13/376,856	)	Examiner: Ali, Shawkat M.
Filed: February 8, 2012	)	
Atty. File No.: 5550-87-PUS	)	SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
Entitled: "HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS"	)	Electronically Submitted

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

Dear Sir:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

☒ Copies of the cited non-patent and/or foreign references are enclosed herewith.

☐ Copies of the cited U.S. patents and/or patent applications are enclosed herewith.

☐ Copies of the cited U.S. patents/unpublished patent applications/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).

☐ Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. _____ filed _____, which is relied upon for an earlier filing date under 35 U.S.C. § 120.

☒ To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English translation/abstracts and/or in the figures, although applicants do not necessarily vouch for the accuracy of the translation.

☐ Examiner's attention is drawn to the following related applications:

- Serial No. _____ filed _____(Attorney Ref. No. _____)

☐ Other:_____

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented.

Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

FEES

☐	**37 CFR 1.97(b)**: No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction): ☐ Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or ☐ Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or ☐ Before the mailing date of a first Office Action on the merits, or ☐ Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114. Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.
☒	**37 CFR 1.97(c)**: The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions: (1) a final action under 37 C.F.R. 1.113 or (2) a notice of allowance under 37 C.F.R. 1.311, or (3) an action that otherwise closes prosecution in the application. This Information Disclosure Statement is accompanied by: ☒ A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970. OR ☐ Please charge Deposit Account 19-1970 in the amount of $180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.
☐	**37 CFR 1.97(d)**: This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c). ☐ This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e) AND ☐ Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of $180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.

Certification (37 C.F.R. 1.97(e))
(Applicable only if checked)

☒ The undersigned certifies that:

☒ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(1).

☒ A copy of the communication from the foreign patent office is enclosed.

OR

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

SHERIDAN ROSS P.C.

By: _____

Jason H. Vick
Registration No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202-5141
(303) 863-9700

Date: 10 Sept '14

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	)	Group Art Unit: 2633
Application No.: 13/376,856	)	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	)	Confirmation No.: 7171
Atty. File No.: 5550-87-PUS	)	

For: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

AMENDMENT AND RESPONSE

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

Madam:

Applicants submit this Amendment and Response to address the Office Action having a mailing date of June 17, 2014. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are shown in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Specification:

Please amend the first paragraph of the of the originally filed specification beneath the heading "RELATED APPLICATION DATA" with the following:

[0001] This application is a national stage application under 35 U.S.C. 371 of PCT Application No. PCT/US2010/046088 having an international filing date of August 20, 2010, which designated the United States, which PCT application claims the benefit of and priority under 35 U.S.C. §119(e) to U.S. Patent Application No. 61/235,909, filed August 21, 2009, entitled "Header Repetition Scheme in Packet-Based OFDM Systems," each of which ~~is~~are incorporated herein by reference in ~~its~~their entirety.

Please delete the heading "CROSS REFERENCE TO RELATED APPLICATION" and paragraph submitted in the December 8, 2011 Preliminary Amendment.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An OFDM (Orthogonal Frequency Division Multiplexing) communication method comprising:

transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of ~~header~~ OFDM symbols that carry header bits; and

transmitting or receiving a second frame having a plurality of header bits using D ~~header~~ OFDM symbols, wherein each of the D OFDM ~~header symbol~~symbols ~~carries~~carry the plurality of header bits.

2-4. (Cancelled)

5. (Previously Presented) The method of claim 1, further comprising modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols.

6-9. (Cancelled)

10. (Original) The method of claim 1, wherein a header of the second frame comprises a bit field that indicates the value for D.

11. (Previously Presented) The method of claim 1, wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value of D.

12-15. (Cancelled)

16. (Original) The method of claim 1, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

17-18. (Cancelled)

19. (Currently Amended) An OFDM (Orthogonal Frequency Division Multiplexing) transceiver capable of transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of ~~header~~ OFDM symbols that carry header bits and transmitting or receiving a second frame having a plurality of header bits using D ~~header~~ OFDM symbols, wherein each ~~OFDM header symbol carries~~of the D OFDM symbols carry the plurality of header bits.

20-23. (Cancelled)

24. (Previously Presented) The transceiver of claim 19, further comprising a modulation module capable of modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order.

25-28. (Cancelled)

29. (Previously Presented)The transceiver of claim 19, wherein a header of the second frame comprises a bit field that indicates the value for D.

30. (Previously Presented) The transceiver of claim 19, wherein the MAP frame is transmitted or received with a fixed value for D.

31-34. (Cancelled)

35. (Previously Presented) The transceiver of claim 19, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

36-37. (Cancelled)

38. (Currently Amended) An OFDM (Orthogonal Frequency Division Multiplexing) communication system comprising:

means for transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of ~~header~~ OFDM symbols that carry header bits; and

means for transmitting or receiving a second frame having a plurality of header bits using D ~~header~~ OFDM symbols, wherein each ~~OFDM header symbol carries~~ of the D OFDM symbols carry the plurality of header bits.

39-41. (Cancelled)

42. (Previously Presented) The system of claim 38, further comprising means for modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols.

43-46. (Cancelled)

47. (Original) The system of claim 38, wherein a header of the second frame comprises a bit field that indicates the value for D.

48. (Previously Presented) The system of claim 38, wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value for D.

49-52. (Cancelled)

53. (Original) The system of claim 38, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

54-59. (Cancelled)

60. (Currently Amended) The method of claim 1, wherein the transmitting or receiving is performed by a transceiver including an ASIC (Application Specific Integrated Circuit).

61. (Previously Presented) The method of claim 1, wherein the transmitting or receiving is performed by a transceiver including a digital signal processor.

62. (Currently Amended) The system of claim 19, wherein the OFDM transceiver includes an ASIC (Application Specific Integrated Circuit).

63. (Previously Presented) The system of claim 19, wherein the OFDM transceiver includes a digital signal processor.

64. (Previously Presented) The system of claim 38, wherein the means for transmitting or receiving includes an ASIC.

65. (Previously Presented) The system of claim 38, wherein the transmitting or receiving includes a digital signal processor.

REMARKS

Applicant respectfully requests reconsideration of this application as amended.

By the above amendments, the objections to the claims have been addressed. Withdrawal of the objection is respectfully requested.

While Applicant respectfully submits the objected to terms in the specification and claims are clear, Applicant has amended the objected to terminology to overcome the 35 U.S.C. §112 rejections. Withdrawal of the rejection is respectfully requested.

Independent claim recites, inter alia, ... transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits; and

transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits.

Gu is directed toward a method which selects antennas in a multiple-input, multiple-output (MIMO) wireless local area network (WLAN) that includes a plurality of stations, and each station includes a set of antennas. Plural consecutive packets, received at a station, include plural consecutive sounding packets. Each sounding packet corresponds to a different subset of the set of antennas, and at least one of the plural consecutive packets includes a high throughput (HT) control field including a signal to initiate antenna selection and a number N indicative of a number of sounding packets which follow the at least one packet including the HT control field and which are to be used for antenna selection. A channel matrix is estimated based on a characteristic of the channel as indicated by the received N sounding packets, and a subset of antennas is selected according to the channel matrix.

Gu goes on further to disclose that a regular sounding packet may contain a HT control field in the MAC header.

Gu never discloses the claimed feature of the TXOP descriptor containing a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits.

Gu also never discloses the claimed feature of a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits.

As a matter of fact, since Gu does not even mention the term "symbol, " Gu cannot provide any teaching whatsoever of a TXOP descriptor which contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits.

As such, Gu cannot anticipate or render obvious claim 1. With similar arguments being applicable to comparable features in the other independent claims, all independent claims are distinguishable from the references.

The dependent claims are further distinguishable at least based on the above and the additional feature(s) therein.

With all objections and rejections having been overcome, Applicant respectfully submits the application is in condition for allowance.

A prompt notice of allowance is respectfully solicited.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: December 15, 2014

By: _____

Jason H. Vick
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

PTO/SB/22 (03-13)
Approved for use through 3/31/2013. OMB 0651-0031
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 displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) 5550-87-PUS
Application Number 13/376,856	Filed February 8, 2012
For HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	
Art Unit 2633	Examiner ALI, SHAWKAT M

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):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 1400
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ 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. Form PTO-2038 is attached.

☑ 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 19-1970.

☑ 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/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration number 45,285.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

Signature	Date
	December 15, 2014
Jason H. Vick	303-863-9700
Typed or printed name	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*.

☑ * Total of 1 forms are submitted.

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. 122 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: 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 Patent Application Fee Transmittal

Application Number:	13376856
Filing Date:	08-Feb-2012
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Filer:	Jason Vick/Joanne Vos
Attorney Docket Number:	5550-87-PUS

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

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 $0 paid	1253	1	1400	1400
Miscellaneous:				
			Total in USD ($)	**1400**

Electronic Acknowledgement Receipt

EFS ID:	20958764
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	15-DEC-2014
Filing Date:	08-FEB-2012
Time Stamp:	12:31:21
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1400
RAM confirmation Number	9945
Deposit Account	191970
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		AMEND_01.pdf	1135553 ee8e06cd1958f281dd4d027f893822e6120ea682	yes	9

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Specification	2	2
Claims	3	6
Applicant Arguments/Remarks Made in an Amendment	7	8
Extension of Time	9	9

Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30971 a3ed6da012a9716ab7e0aeb530d9db5d9adc420d	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1166524	

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. 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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/376,856	Filing Date 02/08/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **12/15/2014**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 21	Minus	** 22	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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 number found in the appropriate box in column 1.

LIE
/PARTHENIA D. MERRILL/

This collection of information is required by 37 CFR 1.16. 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 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.

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	5550-87-PUS	7171

62574 7590 02/24/2015

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

NOTIFICATION DATE	DELIVERY MODE
02/24/2015	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):

jvick@sheridanross.com

Office Action Summary	Application No. 13/376,856	Applicant(s) KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12/15/2014*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,5,10,11,16,19,24,29,30,35,38,42,47,48,53 and 60-65* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,5,10,11,16,19,24,29,30,35,38,42,47,48,53 and 60-65* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ 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)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Claims 1, 5, 10, 11, 16, 19, 24, 29, 30, 35, 38, 42, 47, 48, 53 and 60-65 are currently pending.

Information Disclosure Statement (IDS)

3. The IDS submitted on 09/10/2014 has been entered and considered by the Examiner.

Response to Arguments

4. Applicant's arguments with respect to amended claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1,148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

I. Determining the scope and contents of the prior art.
II. Ascertaining the differences between the prior art and the claims at issue.

III. Resolving the level of ordinary skill in the pertinent art.
IV. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1, 5, 10, 11, 16, 19, 24, 29, 30, 35, 38, 42, 47, 48, 53 and 60-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton (US 2005/0135318 A1).

Regarding claim 1. Walton discloses an OFDM (Orthogonal Frequency Division Multiplexing) communication method (**as shown in Figure 1 and as noted in Paragraph 85 the system is MIMO OFDM**) comprising: transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor (**Figure 16, Block 1666A "MPDU," as noted in Paragraph 119: "The one or more frames are referred to as the TXOP" refer to Figure 11, Block 1110 "TXOP" Paragraph 139**), wherein the TXOP descriptor contains a bit field that carry header bits (**Figure 16, Block 1652 "Header" Paragraph 165**); and transmitting or receiving a second frame (**Figure 16, Block 1666B "MPDU" Paragraphs 167-168**) having a plurality of header bits (**Figure 16, Block 1652, Header, "2 Bytes" Paragraph 165**). Although throughout the disclosure Walton discloses OFDM symbols, Walton does not explicitly disclose an integer D OFDM symbols that carry header bits; yet, from the disclosure of Walton, in particular Figure 53 "MAC Frame = 512 OFDM Symbols" and Paragraph 153: "the first portion of BCH [Figure 15 or 53, Block 1510] contains common physical layer overhead, such as pilot signals (header) including timing and frequency acquisitions pilot" and further Paragraph 156 "The CCH [Figure 15 or 53, Block 1520] contains assignments of physical layer bursts on the forward and reverse links, (analogous to consolidated polls for TXOPs)". One skilled in the art would have implemented said Beacon + BCH, 1510, to be D OFDM symbols to carry the

plurality of header bits as said Beacon + BCH (number of subcarriers) can simply be selected based on its system advantages and disadvantages. Therefore, it would have been obvious to one skilled in the art to choose the D (subcarriers) according to the circumstances.

Regarding claims 19 & 38. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 1 due to the similar scope.

Regarding claim 5. Walton further discloses modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols (**Figure 16, Block 1666A/1666B "MPDU" Paragraphs 167-168**).

Regarding claims 24 & 42. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 5 due to the similar scope.

Regarding claim 10. Walton also discloses wherein a header of the second frame comprises a bit field that indicates the value for D (**Figure 16, Block 1652, Header, "2 Bytes" Paragraph 165**).

Regarding claims 29 & 47. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 10 due to the similar scope.

Regarding claim 11. Walton also discloses wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value of D (**Paragraph 153, "the length of the entire BCH is fixed**).

Regarding claims 30 & 48. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 11 due to the similar scope.

Regarding claim 16. Walton also discloses wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2 (**Paragraph 153, "the beacon consists of 2 short OFDM symbols**).

Regarding claims 35 & 53. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 16 due to the similar scope.

Regarding claim 60. Walton also discloses wherein the transmitting or receiving is performed by a transceiver including an ASIC (Applicant Specific Integrated Circuit) (**Paragraph 425, ASIC**).

Regarding claims 62 & 64. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 60 due to the similar scope.

Regarding claim 61. Walton also discloses wherein the transmitting or receiving is performed by a transceiver including a digital signal processor (**Paragraph 92, DSP**).

Regarding claims 63 & 65. Proper treatments are given to these claims and are rejected on the same ground as set forth in claim 61 due to the similar scope.

Conclusions

7. **Examiner's Note:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicants. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicants in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of **amending the claimed invention,** Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHAWKAT M. ALI whose telephone number is (571) 270-1639. The examiner can normally be reached on Monday-Thursday 8:00AM-4:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, SAM K. AHN can be reached on (571) 272-3044. 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.

/SHAWKAT M ALI/

Examiner, Art Unit 2633

/SAM K AHN/

Supervisory Patent Examiner, Art Unit 2633

Notice of References Cited	Application/Control No. 13/376,856	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2005/0135318	06-2005	Walton et al.	370/338
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2633
				Examiner Name	Ali, Shawkat M.
Sheet	1	of	1	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] (if known)	Filing Date MM-DD-YYYY	Name of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
/S.A./	1	Official Action (including translation) for Chinese Patent Application No. 201080037081.2, mailed July 3, 2014 (Attorney Ref. No.: 5550-87-PCN)

Examiner Signature	/Shawkat Ali/	Date Considered	02/09/2015

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015							
	1	✓	✓							
	2	-	-							
	3	-	-							
	4	-	-							
	5	✓	✓							
	6	-	-							
	7	-	-							
	8	-	-							
	9	-	-							
	10	✓	✓							
	11	✓	✓							
	12	-	-							
	13	-	-							
	14	-	-							
	15	-	-							
	16	✓	✓							
	17	-	-							
	18	-	-							
	19	✓	✓							
	20	-	-							
	21	-	-							
	22	-	-							
	23	-	-							
	24	✓	✓							
	25	-	-							
	26	-	-							
	27	-	-							
	28	-	-							
	29	✓	✓							
	30	✓	✓							
	31	-	-							
	32	-	-							
	33	-	-							
	34	-	-							
	35	✓	✓							
	36	-	-							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015							
	37	-	-							
	38	✓	✓							
	39	-	-							
	40	-	-							
	41	-	-							
	42	✓	✓							
	43	-	-							
	44	-	-							
	45	-	-							
	46	-	-							
	47	✓	✓							
	48	✓	✓							
	49	-	-							
	50	-	-							
	51	-	-							
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	54	-	-							
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	57	-	-							
	58	-	-							
	59	-	-							
	60	✓	✓							
	61	✓	✓							
	62	✓	✓							
	63	✓	✓							
	64	✓	✓							
	65	✓	✓							

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2633
				Examiner Name	Ali, Shawkat M.
Sheet	1	of	1	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] (if known)	Filing Date MM-DD-YYYY	Name of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
	1	Official Action (including translation) for Chinese Patent Application No. 201080037081.2, mailed March 23, 2015 (Attorney Ref. No.: 5550-87-PCN)
	2	Office Action for European Patent Application No. 10748023.8, mailed Feb. 17, 2015 (Attorney Ref. No.: 5550-87-PEP)

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Patent Application Fee Transmittal

Application Number:	13376856
Filing Date:	08-Feb-2012
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Filer:	Jason Vick/Joanne Vos
Attorney Docket Number:	5550-87-PUS

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

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($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	22187879
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	28-APR-2015
Filing Date:	08-FEB-2012
Time Stamp:	12:39:07
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	13900
Deposit Account	191970
Authorized User	VICK, JASON H.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS_04.pdf	54427 edb1b46915c93b9b2c2f9a58b45d5b2a962e92bb	yes	4
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	4	
Warnings:					
Information:					
2	Non Patent Literature	5550-87-PCN_OA_03-23-2015.pdf	381289 796720202f9451b200e30d4455bec36f2232e331	no	7
Warnings:					
Information:					
3	Non Patent Literature	5550-87-PEP_OA_02-17-2015.pdf	2570634 5d4f3cd1e7bb98adf3dca272ad3338cd14af5749	no	4
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30606 5dabeb4b680b627e0542d9390fd59a7155078c1e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3036956		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:	)	Group Art Unit: 2633
Joon Bae Kim	)	Confirmation No.: 7171
Serial No.: 13/376,856	)	Examiner: Ali, Shawkat M.
Filed: February 8, 2012	)	
Atty. File No.: 5550-87-PUS	)	SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
Entitled: "HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS"	)	Electronically Submitted

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

Dear Sir:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

☒ Copies of the cited non-patent and/or foreign references are enclosed herewith.

☐ Copies of the cited U.S. patents and/or patent applications are enclosed herewith.

☐ Copies of the cited U.S. patents/unpublished patent applications/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).

☐ Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. _____ filed _____, which is relied upon for an earlier filing date under 35 U.S.C. § 120.

☒ To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English translation/abstracts and/or in the figures, although applicants do not necessarily vouch for the accuracy of the translation.

☐ Examiner's attention is drawn to the following related applications:

- Serial No. _____ filed _____(Attorney Ref. No. _____)

☐ Other:_____

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented.

Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

FEES

☐	**37 CFR 1.97(b)**: No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction): ☐ Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or ☐ Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or ☐ Before the mailing date of a first Office Action on the merits, or ☐ Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114. Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.
☐	**37 CFR 1.97(c)**: The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions: (1) a final action under 37 C.F.R. 1.113 or (2) a notice of allowance under 37 C.F.R. 1.311, or (3) an action that otherwise closes prosecution in the application. This Information Disclosure Statement is accompanied by: ☐ A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970. OR ☐ Please charge Deposit Account 19-1970 in the amount of $180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.
☒	**37 CFR 1.97(d)**: This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c). ☒ This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e) AND ☒ Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of $180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.

Certification (37 C.F.R. 1.97(e))
(Applicable only if checked)

☒ The undersigned certifies that:

☒ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(1).

☒ A copy of the communication from the foreign patent office is enclosed.

OR

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

SHERIDAN ROSS P.C.

By: /Jason H. Vick/
Jason H. Vick
Registration No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202-5141
(303) 863-9700

Date: April 28, 2015

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/376,856	Filing Date	2012-02-08	Docket Number (if applicable)	5550-87-PUS	Art Unit	2633
First Named Inventor	Joon Bae Kim			Examiner Name	ALI, SHAWKAT M		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 191970

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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.

Signature of Registered U.S. Patent Practitioner			
Signature	/Jason H. Vick/	Date (YYYY-MM-DD)	2015-08-21
Name	Jason H. Vick	Registration Number	45285

This collection of information is required by 37 CFR 1.114. 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.

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

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.

Electronic Patent Application Fee Transmittal

Application Number:	13376856
Filing Date:	08-Feb-2012
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Filer:	Jason Vick/Joanne Vos
Attorney Docket Number:	5550-87-PUS

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

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 $0 paid	1253	1	1400	1400
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**2600**

Electronic Acknowledgement Receipt

EFS ID:	23276986
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-87-PUS
Receipt Date:	21-AUG-2015
Filing Date:	08-FEB-2012
Time Stamp:	14:14:21
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$2600
RAM confirmation Number	475
Deposit Account	191970
Authorized User	VICK, JASON H.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		AMEND_02_AF.pdf	236674 5bd3ce8980d00d21a28e458bf7d0c5b78926899b	yes	10

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	5
Applicant Arguments/Remarks Made in an Amendment	6	9
Extension of Time	10	10

Warnings:

Information:

2	Request for Continued Examination (RCE)	RCE_01.pdf	697735 0dbea49c363c6bda0460e4fd44e34101b90dbe6d	no	3

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	32892 29b2e61bfca3512a52fe62d483d30477b22c710b	no	2

Warnings:

Information:

Total Files Size (in bytes):	967301

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	Group Art Unit: 2633
Application No.: 13/376,856	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	Confirmation No.: 7171
Atty. File No.: 5550-87-PUS	

For: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

AMENDMENT AFTER FINAL

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

Madam:

Applicants submit this Amendment After Final to address the Final Office Action having a mailing date of February 24, 2015. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

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

Remarks begin on page 6 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An OFDM (Orthogonal Frequency Division Multiplexing) communication method comprising:

transmitting or receiving, by a transceiver, a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits; and

transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits.

2-4. (Cancelled)

5. (Previously Presented) The method of claim 1, further comprising modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols.

6-9. (Cancelled)

10. (Original) The method of claim 1, wherein a header of the second frame comprises a bit field that indicates the value for D.

11. (Previously Presented) The method of claim 1, wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value of D.

12-15. (Cancelled)

16. (Original) The method of claim 1, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

17-18. (Cancelled)

19. (Previously Presented) An OFDM (Orthogonal Frequency Division Multiplexing) transceiver capable of transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits and transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits.

20-23. (Cancelled)

24. (Previously Presented) The transceiver of claim 19, further comprising a modulation module capable of modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order.

25-28. (Cancelled)

29. (Previously Presented) The transceiver of claim 19, wherein a header of the second frame comprises a bit field that indicates the value for D.

30. (Previously Presented) The transceiver of claim 19, wherein the MAP frame is transmitted or received with a fixed value for D.

31-34. (Cancelled)

35. (Previously Presented) The transceiver of claim 19, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

36-37. (Cancelled)

38. (Previously Presented) An OFDM (Orthogonal Frequency Division Multiplexing) communication system comprising:

means for transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits; and

means for transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits.

39-41. (Cancelled)

42. (Previously Presented) The system of claim 38, further comprising means for modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols.

43-46. (Cancelled)

47. (Original) The system of claim 38, wherein a header of the second frame comprises a bit field that indicates the value for D.

48. (Previously Presented) The system of claim 38, wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value for D.

49-52. (Cancelled)

53. (Original) The system of claim 38, wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2.

54-59. (Cancelled)

60. (Previously Presented) The method of claim 1, wherein the transmitting or receiving is performed by a transceiver including an ASIC (Application Specific Integrated Circuit).

61. (Previously Presented) The method of claim 1, wherein the transmitting or receiving is performed by a transceiver including a digital signal processor.

62. (Previously Presented) The system of claim 19, wherein the OFDM transceiver includes an ASIC (Application Specific Integrated Circuit).

63. (Previously Presented) The system of claim 19, wherein the OFDM transceiver includes a digital signal processor.

64. (Previously Presented) The system of claim 38, wherein the means for transmitting or receiving includes an ASIC.

65. (Previously Presented) The system of claim 38, wherein the transmitting or receiving includes a digital signal processor.

REMARKS

Applicant respectfully requests reconsideration of this application as amended.

Independent claim 1 recites, inter alia,...

transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the *TXOP descriptor contains* a bit field that indicates a value for an integer, D, wherein *the integer D indicates a number of OFDM symbols that carry header bits*; and

transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein *each of the D OFDM symbols carry the plurality of header bits*. (Emphasis Added)

The claims are rejected in view of Walton – this rejection is respectfully traversed.

The Office Action asserts:

> Regarding claim 1. Walton discloses an OFDM (Orthogonal Frequency Division Multiplexing) communication method (as shown in Figure 1 and as noted in Paragraph 85 the system is MIMO OFDM) comprising: transmitting or receiving a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor (Figure 16, Block 1666A "MPDU," as noted in Paragraph 119: "The one or more frames are referred to as the TXOP" refer to Figure 11, Block 1110 "TXOP" Paragraph 139), wherein the TXOP descriptor contains a bit field that carry header bits (Figure 16, Block 1652 "Header" Paragraph 165); and transmitting or receiving a second frame (Figure 16, Block 1666B "MPDU" Paragraphs 167-168) having a plurality of header bits (Figure 16, Block 1652, Header, "2 Bytes" Paragraph 165). (See pg. 3)

For the feature of "transmitting or receiving, by a transceiver, a Media Access Plan (MAP) frame comprising a Transmission Opportunity (TXOP) descriptor..." the Office Action relies on Fig. 16, Block 1666A.

Fig. 16, is a MAC PDU. Specifically, FIG. 16 depicts the formation of an example MAC PDU 1660 from a packet 1610, which may be an IP datagram or an Ethernet segment, in this example.

Walton goes to state that: "one aspect allows for a partial MPDU 1650 to be transmitted, allowing for efficient packing in a MAC PDU 1660. In this example, the untransmitted bytes of any partial MPDUs 1650 left over from a previous transmission may be included, identified by partial MPDU 1664. These bytes 1664 will be transmitted ahead of any new PDUs 1666 (i.e. LL

PDUs or control PDUs) in the current frame. Header 1662 (two bytes in this example) includes a MUX pointer, which points to the start of the first new MPDU (MPDU 1666A in this example) to be transmitted in the current frame. Header 1662 may also include a MAC address"

Fig. 11 of Walton is an example of a TXOP.

Walton describes Fig. 11 as:

> FIG. 11 depicts an example embodiment of a TXOP 1110 illustrating reducing the amount of preamble transmission required. TXOP 1110 comprises preamble 1120 followed by N consecutive transmissions 1130A-1130N. An optional block ACK request 1140 may be appended. In this example, a transmission 1130 comprises a header and a packet. Contrast TXOP 1110 with TXOP 790 of FIG. 7, in which each frame 740 comprises a preamble, in addition to the header and packet. By sending a single preamble, the required preamble transmission is one preamble instead of N preambles, for the same amount of transmitted data.
>
> Thus, the preamble 1120 may be eliminated from successive transmissions. The initial preamble 1120 may be used by the receiver to acquire the signal, as well as for fine frequency acquisition for OFDM. For MIMO transmissions, the initial preamble 1120 may be extended compared to the current OFDM preamble to enable the receiver to estimate the spatial channels. However, subsequent frames within the same TXOP may not require additional preambles. Pilot tones within the OFDM symbols are generally sufficient for signal tracking. In an alternate embodiment, additional (preamble-like) symbols may be interspersed periodically during the TXOP 1110. However, the overall preamble overhead may be significantly reduced. The preamble may be sent only as necessary, and may be sent differently based on the amount of time elapsed since a previously transmitted preamble.

However, there is no structure described in Walton that is comparable to the claimed feature of "TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits…"

Applicant respectfully submits, as is clear from above, there is no bit field in Walton which indicates a number of OFDM symbols that carry header bits.

As specifically stated by Walton: "TXOP 1110 comprises preamble 1120 followed by N consecutive transmissions 1130A-1130N. An optional block ACK request 1140 may be appended" – this can be seen in Fig. 11 of Walton.

The Office Action further states: "wherein the TXOP descriptor contains a bit field that carry header bits (Figure 16, Block 1652 "Header" Paragraph 165).

However, this is not what is claimed. What is actually claimed, as recited for example in claim 1, is:

…wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits…

Block 1652 in Fig. 16 of Walton does not disclose this feature. 1652 is defined in Walton as "A MUX header **1652** is attached to each LL PDU **1640**. An example MUX header **1652** may comprise a length and a type (the header **1652** is two bytes in this example). A similar header may be formed for each control PDU (i.e. LLC and RLC PDUs). The LL PDU **1640** (or LLC or RLC PDU) forms the payload **1654**. The header **1652** and payload **1654** form the MUX sublayer PDU (MPDU) **1650** (MUX sublayer PDUs are also referred to herein as MUX PDUs)."

Nowhere does Walton teach, suggest or disclose the claimed feature of "the integer D indicates a number of OFDM symbols that carry header bits."

The Office Action further states:

…and transmitting or receiving a second frame (Figure 16, Block 1666B "MPDU" Paragraphs 167-168) having a plurality of header bits (Figure 16, Block 1652, Header, "2 Bytes" Paragraph 165).

Again, this is not the claimed feature. Claim 1 actually recites "transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits."

Walton, in paragraphs 165 and 167-168, does not disclose this feature. 1652 in Walton is associated with 1666N-1. 1652 is described as "An example MUX header **1652** may comprise a length and a type (the header **1652** is two bytes in this example)."

Nowhere does Walton teach, suggest or disclose the claimed feature of *each of the D OFDM symbols carry the plurality of header bits*.

The Office Action further states that:

One skilled in the art would have implemented said Beacon+ BCH, 1510, to be D OFDM symbols to carry the plurality of header bits as said Beacon + BCH (number of subcarriers) can simply be selected based on its system advantages and disadvantages. Therefore, it would have been obvious to one skilled in the art to choose the D (subcarriers) according to the circumstances.

Applicant respectfully disagrees. Walton specifically states that an object of the invention is to significantly reduce preamble overhead – why would one of ordinary skill in the art have "implemented said Beacon+ BCH, 1510, to be D OFDM symbols to carry the plurality

of header bits as said Beacon + BCH (number of subcarriers)" as asserted by the Office since it is contrary to the object of Walton?

Applicant respectfully submits that at least based on the above, claim 1 is not obvious in view of Walton.

With similar arguments being applicable to comparable features in the other independent claims, all independent claims are distinguishable from the references.

The dependent claims are further distinguishable at least based on the above and the additional feature(s) therein.

With all rejections having been overcome, Applicant respectfully submits the application is in condition for allowance.

A prompt notice of allowance is respectfully solicited.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby Petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: August 21, 2015

By: /Jason H. Vick/

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Denver, Colorado 80202
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PTO/SB/22 (03-13)
Approved for use through 3/31/2013. OMB 0651-0031
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 5550-87-PUS

Application Number: 13/376,856

Filed: February 8, 2012

For: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

Art Unit: 2633

Examiner: ALI, SHAWKAT M

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):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 1,400
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ 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. Form PTO-2038 is attached.

☑ 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 19-1970.

☑ 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/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration number 45285.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Jason H. Vick/ — Signature

August 21, 2015 — Date

Jason H. Vick — Typed or printed name

303-863-9700 — 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*.

☑ * Total of 1 forms are submitted.

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. 122 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: 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.

PTO/SB/06 (09-11)
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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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/376,856	Filing Date 02/08/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **08/21/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 21	Minus	** 22	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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 number found in the appropriate box in column 1.

LIE
/BONNIE COLE/

This collection of information is required by 37 CFR 1.16. 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 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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	5550-87-PUS	7171

62574 7590 12/31/2015

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EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

NOTIFICATION DATE	DELIVERY MODE
12/31/2015	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):

jvick@sheridanross.com

Office Action Summary	Application No. 13/376,856	Applicant(s) KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08/21/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,5,10,11,16,19,24,29,30,35,38,42,47,48,53 and 60-65* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,5,10,11,16,19,24,29,30,35,38,42,47,48,53 and 60-65* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *12/08/2011* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ 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)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after Final Rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office Action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 21, 2015 has been entered.

3. Claims 1, 5, 10, 11, 16, 19, 24, 29, 30, 35, 38, 42, 47, 48, 53 and 60-65 are currently pending.

Information Disclosure Statement (IDS)

4. The IDS submitted on 04/28/2015 has been entered and considered by the Examiner.

Claim Objections

5. Claims 16, 35 and 53 are objected to because in line 1 "D can take" should be replaced with "D takes". Claims 60 and 61 are objected to because in line 2 "a transceiver" should be replaced with "the transceiver". Claim 64 is objected to because in line 2 "an ASIC" should be

replaced with "an ASIC (Application Specific Integrated Circuit)". Appropriate corrections are required.

Claim Interpretations

6. The following is a quotation of 35 U.S.C. 112(f):

> (f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

7. Claim 19 recites limitation "transceiver (*means*) capable of (*for*) transmitting (f*unction*) or receiving (*function*)…" and claim 38 recites limitation "means for transmitting or receiving…" have been interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

Since the claim limitation(s) invokes 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, claims 19 and 38 have been interpreted to cover the corresponding structure described in the Specification that achieves the claimed function, and equivalents thereof.

A review of the Specification shows that the following appears to be the corresponding structure described in the specification for the 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph limitation:

Transceiver capable of transmitting or receiving and means for transmitting or receiving interpreted as i.e. Figure 2 Block 200 "Transceiver" and Paragraph 38.

If Applicant wishes to provide further explanation or dispute the Examiner's interpretation of the corresponding structure, applicant must identify the corresponding structure with reference to the Specification by page and line number, and to the drawing, if any, by reference characters in response to this Office Action.

If Applicant does not intend to have the claim limitation(s) treated under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112 , sixth paragraph, Applicant may amend the claim(s) so that they will clearly not invoke 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, or present a sufficient showing that the claim recites/recite sufficient structure, material, or acts for performing the claimed function to preclude application of 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

For more information, see MPEP § 2173 *et seq.* and *Supplementary Examination Guidelines for Determining Compliance With 35 U.S.C. 112 and for Treatment of Related Issues in Patent Applications*, 76 FR 7162, 7167 (Feb. 9, 2011).

Claim Rejections - 35 USC § 112

8. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. **Claims 24 and 42** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claims 24 and 42 recite "a modulation module (*means*) capable of (*for*) modulating (*function*) and means for modulating" these are limitations that invoke 35 U.S.C. 112(f) or sixth paragraph. However, the written description fails to disclose the corresponding structure, material, or acts for the claimed functions of these above units and just displays the units as boxes in the drawings and the functions are described in the disclosure almost identically to the claims.

Applicant may:

(a) Amend the claim so that the claim limitation will no longer be interpreted as a limitation under 35 U.S.C. 112(f), sixth paragraph; or

(b) Amend the written description of the specification such that it expressly recites what structure, material, or acts perform the claimed function without introducing any new matter (35 U.S.C. 132(a)).

If Applicant is of the opinion that the written description of the Specification already implicitly or inherently discloses the corresponding structure, material, or acts so that one of ordinary skill in the art would recognize what structure, material, or acts perform the claimed function, applicant should clarify the record by either:

(a) Amending the written description of the Specification such that it expressly recites the corresponding structure, material, or acts for performing the claimed function and clearly links or associates the structure, material, or acts to the claimed function, without introducing any new matter (35 U.S.C. 132(a)); or

(b) Stating on the record what the corresponding structure, material, or acts, which are implicitly or inherently set forth in the written description of the specification, perform the claimed function. For more information, see 37 CFR 1.75(d) and MPEP §§ 608.01(o) and 2181.

10. **Claims 5, 24 and 42** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

In claim 5, line 1-2 the wordings "the header bits" (as well as claims 24 & 42 line 2) presents an ambiguity. It is not readily apparent whether "the header bits" referring to "MAP frame (e.g. recited in claim 1, line 3)", "second frame (e.g. recited in claim 1, line 7)" or both; thus, the term "the header bits" renders the claim 5 as well as claims 24 and 42 indefinite.

11. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

12. **Claims 24 and 42** are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the Specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification does not provide adequate structural support for claim limitations "modulation module capable of modulating and means for modulating".

Response to Arguments

13. Applicant's arguments with respect to the independent claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

14. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1,148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

I. Determining the scope and contents of the prior art.
II. Ascertaining the differences between the prior art and the claims at issue.
III. Resolving the level of ordinary skill in the pertinent art.
IV. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

15. Claims 1, 5, 10, 11, 16, 19, 24, 29, 30, 35, 38, 42, 47, 48, 53 and 60-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto (US 2004/0179517 A1) and in view of Nanda (US 2005/0135284 A1).

Regarding claim 1. Yamamoto teaches an OFDM (Orthogonal Frequency Division Multiplexing) communication method (**Figure 11A, "MAC Header" & "Payload" Paragraph 14: wireless communication method & Paragraph 52: IEEE.11 (OFDM)**) comprising: transmitting or receiving, by a transceiver (**as shown in Figure 6A and as noted in Paragraph 57 that the Access Point and each Station are communicating bi-directionally (transceiver)**), a Media Access Plan (MAP) frame contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits (**Figure 11A, "MAC Header" (MAP frame) and as noted in Paragraph 52 that the header described in IEEE.11, a 2-byte (D) area is used to indicate a fame length**); and transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits (**Figure 5, "Wireless Packet" as noted in Paragraph 43: one or more wireless packets (second frame) and Paragraph 52. Also, note that for the purpose of examining claim 1 and its dependent claims in which the content of the frames is not used to make any decision that content is nonfunctional descriptive material and, therefore, lacks patentable weight**). Although Yamamoto teaches a frame, Yamamoto does not explicitly disclose a frame comprising a Transmission Opportunity (TXOP). In a similar field of endeavor, Nanda disclose a frame comprising a Transmission Opportunity (TXOP) (**Figure 11, Block 1110 "TXOP" Paragraph 138**). At the time the invention was made it would have been obvious to modify Yamamoto's frame to include TXOP as in Nanda. One ordinary skill in the art would be motivated to do so to reduce the amount of preamble transmission requirement, **Paragraph 138**.

Regarding claim 5. The combination of Yamamoto and Nanda teaches the method of claim 1. In addition, Nanda discloses modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than another of the OFDM symbols (**Figure 16, Block 1666A/1666B "MPDU" Paragraphs 167-169**).

Regarding claim 10. Nanda further discloses wherein a header of the second frame comprises a bit field that indicates the value for D (**Figure 16, Block 1652, Header, "2 Bytes" Paragraph 164**).

Regarding claim 11. Nanda also discloses wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value of D (**Paragraph 153, "the length of the entire BCH is fixed**).

Regarding claim 16. Nanda also discloses wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2 (**Paragraph 152, "the beacon consists of 2 short OFDM symbols**).

Regarding claim 60. Nanda also discloses wherein the transmitting or receiving is performed by a transceiver including an ASIC (Applicant Specific Integrated Circuit) (**Paragraph 427: ASIC**).

Regarding claim 61. Nanda also discloses wherein the transmitting or receiving is performed by a transceiver including a digital signal processor (**Paragraph 427: DSP**).

Regarding claim 19. Yamamoto teaches an OFDM (Orthogonal Frequency Division Multiplexing) transceiver capable of transmitting or receiving (**as shown in Figure 6A and as noted in Paragraph 57 that the Access Point and each Station are communicating bi-directionally (transceiver) & Paragraph 52: IEEE.11 (OFDM)**) a Media Access Plan (MAP) frame contains a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits (**Figure 11A, "MAC Header" (MAP frame) and as noted in Paragraph 52 that the header described in IEEE.11, a 2-byte (D) area is used to indicate a fame length**) and transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits (**Figure 5, "Wireless Packet" as noted in Paragraph 43: one or more wireless packets (second frame) and Paragraph 52. Also, note that for the purpose of examining claim 19 and its dependent claims in which the content of the frames is not used to make any decision that content is nonfunctional descriptive material and, therefore, lacks patentable weight**). Although Yamamoto teaches a frame, Yamamoto does not explicitly disclose a frame comprising a Transmission Opportunity (TXOP). In a similar field of endeavor, Nanda disclose a frame comprising a Transmission Opportunity (TXOP) (**Figure 11, Block 1110 "TXOP" Paragraph 138**). At the time the invention was made it would have been obvious to modify Yamamoto's frame to include TXOP as in Nanda. One ordinary skill in the art would be motivated to do so to reduce the amount of preamble transmission requirement, **Paragraph 138**.

Regarding claim 24. The combination of Yamamoto and Nanda teaches the transceiver of claim 19. In addition, Nanda discloses a modulation module capable of modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto the D OFDM symbols in a different order (**Figure 16, Block 1666A/1666B "MPDU" Paragraphs 167-169**).

Regarding claim 29. Nanda further discloses wherein a header of the second frame comprises a bit field that indicates the value for D (**Figure 16, Block 1652, Header, "2 Bytes" Paragraph 164**).

Regarding claim 30. Nanda also discloses wherein the MAP frame is transmitted or received with a fixed value for D (**Paragraph 153, "the length of the entire BCH is fixed**).

Regarding claim 35. Nanda also discloses wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2 (**Paragraph 152, "the beacon consists of 2 short OFDM symbols**).

Regarding claim 62. Nanda also discloses wherein the OFDM transceiver includes an ASIC (Application Specific Integrated Circuit) (**Paragraph 427: ASIC**).

Regarding claim 63. Nanda also discloses wherein the OFDM transceiver includes a digital signal processor (**Paragraph 427: DSP**).

Regarding claim 38. Yamamoto teaches an OFDM (Orthogonal Frequency Division Multiplexing) communication system (**as shown in Figure 6A (system) and as noted in**

Paragraph 57 that the Access Point and each Station are communicating bi-directionally (transceiver) & Paragraph 52: IEEE.11 (OFDM)) comprising: means for transmitting or receiving a Media Access Plan (MAP) frame comprising a bit field that indicates a value for an integer, D, wherein the integer D indicates a number of OFDM symbols that carry header bits (**Figure 6A & Figure 11A, "MAC Header" (MAP frame) and as noted in Paragraph 52 that the header described in IEEE.11, a 2-byte (D) area is used to indicate a fame length**); and means for transmitting or receiving a second frame having a plurality of header bits using D OFDM symbols, wherein each of the D OFDM symbols carry the plurality of header bits (**Figure 6A & Figure 5, "Wireless Packet" as noted in Paragraph 43: one or more wireless packets (second frame) and Paragraph 52. Also, note that for the purpose of examining claim 38 and its dependent claims in which the content of the frames is not used to make any decision that content is nonfunctional descriptive material and, therefore, lacks patentable weight**). Although Yamamoto teaches a frame, Yamamoto does not explicitly disclose a frame comprising a Transmission Opportunity (TXOP). In a similar field of endeavor, Nanda disclose a frame comprising a Transmission Opportunity (TXOP) (**Figure 11, Block 1110 "TXOP" Paragraph 138**). At the time the invention was made it would have been obvious to modify Yamamoto's frame to include TXOP as in Nanda. One ordinary skill in the art would be motivated to do so to reduce the amount of preamble transmission requirement, **Paragraph 138**.

Regarding claim 42. The combination of Yamamoto and Nanda teaches the system of claim 38. In addition, Nanda discloses means for modulating the header bits onto the D OFDM symbols, wherein the header bits are modulated onto one of the D OFDM symbols in a different order than

another of the OFDM symbols (**Figure 16, Block 1666A/1666B "MPDU" Paragraphs 167-169**).

Regarding claim 47. Nanda further discloses wherein a header of the second frame comprises a bit field that indicates the value for D (**Figure 16, Block 1652, Header, "2 Bytes" Paragraph 164**).

Regarding claim 48. Nanda also discloses wherein the MAP frame is transmitted or received with a fixed value for D that is equal to the maximum value for D (**Paragraph 153, "the length of the entire BCH is fixed**).

Regarding claim 53. Nanda also discloses wherein D can take on the values of 1 and 2 and a fixed value of D for the MAP frame is 2 (**Paragraph 152, "the beacon consists of 2 short OFDM symbols**).

Regarding claim 64. Nanda also discloses wherein the means for transmitting or receiving includes an ASIC (**Paragraph 427: ASIC**).

Regarding claim 65. Nanda also discloses wherein the transmitting or receiving includes a digital signal processor (**Paragraph 427: DSP**).

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHAWKAT M. ALI whose telephone number is (571) 270-1639. The examiner can normally be reached on Monday-Thursday 8:30AM-4:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, SAM K. AHN can be reached on (571) 272-3044. 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.

/SHAWKAT M ALI/

Examiner, Art Unit 2633

Notice of References Cited	Application/Control No. 13/376,856	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2004/0179517 A1	09-2004	Yamamoto, Yukihiro	H04L1/0039	370/356
*	B	US-2005/0135284 A1	06-2005	Nanda, Sanjiv	H04L29/06068	370/294
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015	12/23/2015						
	1	✓	✓	✓						
	2	-	-	-						
	3	-	-	-						
	4	-	-	-						
	5	✓	✓	✓						
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	10	✓	✓	✓						
	11	✓	✓	✓						
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	14	-	-	-						
	15	-	-	-						
	16	✓	✓	✓						
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	19	✓	✓	✓						
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	30	✓	✓	✓						
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	32	-	-	-						
	33	-	-	-						
	34	-	-	-						
	35	✓	✓	✓						
	36	-	-	-						

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015	12/23/2015						
	37	-	-	-						
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	64	✓	✓	✓						
	65	✓	✓	✓						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	31	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same ((transmission adj opportunity) or txop) same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:03
L24	10	("20050226204" | "20050254465" | "20060018268" | "20070058575" | "20080036909" | "20080181155" | "20090040965" | "7324605").PN. OR ("8817698").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 11:22
L25	73	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same ((transmission adj opportunity) or txop) same (header packet peamble)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:39
L26	42	25 not 1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:39
L27	8	26 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:40
L28	19	("20030016686" | "20050055406" | "20050147034" | "20050175014" | "20060168313" | "6426943" | "6473425" | "6606301" | "6832261" | "6959002" | "7310337" | "7457313" | "7580355").PN. OR ("8139593").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 11:51
L29	64423	(370/229,294,328,329,336,338,356,449).ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:26
L30	28065	(375/219,260,267,295,316).ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:26
L31	2815	(H04B1/38 H04B7/155).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:27
L32	1559	(H04J1/00 H04J3/00 H04J3/24 H04J11/00).cpc.	US-PGPUB; USPAT;	OR	ON	2015/12/27 12:28

			USOCR			
L33	8852	(H04L1/00 H04L1/08 H04L5/00 H04L12/26 H04L12/43 H04L12/56 H04L12/403 H04L27/28).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:30
L34	440	(H04M1/00).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:31
L36	22074	(H04W4/00 H04W24/00 H04W52/02 H04W72/04 H04W72/12 H04W74/08).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:33
L37	117614	29 30 31 32 33 34 36	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:33
L38	37065	37 and ofdm$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:33
L39	503	38 and (((transmission adj opportunity) or txop) same (header packet peamble))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:34
L40	244	38 and (((transmission adj opportunity) or txop) same (header peamble))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:34
L41	37	40 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:35
L42	10	("20060239223" | "20070232358" | "20080089261" | "20080130603" | "6917598" | "7002929" | "7046649").PN. OR ("8155695").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:57
L43	761	37 and ofdm$1 and ((transmission adj opportunity) or txop) and header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:18
L44	186	43 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:18
L45	149	44 not (1 27 41)	US-PGPUB;	OR	ON	2015/12/27

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:19
L46	141	45 and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:20
L47	130	45 and ("MAC" "MAP") and frame	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:20
L48	16	("20020141375" | "20040166870" | "20050075104" | "20070099567" | "20070224936" | "20080177751" | "20080254810" | "20090054002" | "20090147867" | "20090176454" | "20090196173" | "20090257379" | "20100085903" | "5237587" | "5774876" | "6249680").PN. OR ("8995996").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 13:58
S1	1	(13/376856).APP.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/06/06 10:59
S2	2601	((Joon) near2 (Kim)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:11
S3	237	((Marcos) near2 (Tzannes)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:12
S4	2832	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:12
S5	3	S4 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:13
S6	28058	(370/338,356,458,468).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51

S7	16810	(375/219,260).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S8	44525	S6 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S9	158	S8 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S10	80	S8 and "OFDM" and ("TXOP" same ("MAC" "MAP"))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52
S11	45	S10 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52
S13	467	beacon near2 header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/10 11:46
S14	21	"OFDM" same "TXOP" same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 15:35
S15	325	"TXOP" with bit	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
S16	3069	"OFDM" same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/12/15 16:59

			DERWENT; IBM_TDB			
S17	26	S15 and S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
S18	250	(("20120275528") or ("20140233615") or ("8718118") or ("20150188742") or ("8953657") or ("9154355") or ("8537796") or ("20110080963") or ("20110110437") or ("20130336182") or ("20120189072") or ("20110216814") or ("20140119410") or ("8472537") or ("20120057483") or ("20040047296") or ("20130202017") or ("20080049601") or ("7522514") or ("7590071") or ("20090225817") or ("20140036711") or ("20130003587") or ("20090268832") or ("20110080857") or ("20100098039") or ("7916625") or ("20130094517") or ("20110211477") or ("20140334323") or ("20150003274") or ("20090296614") or ("9166860") or ("20150009855") or ("20100220725") or ("7804765") or ("20140126655") or ("20120069877") or ("20090274061") or ("8284800") or ("8755264") or ("20120236879") or ("8553579") or ("7729281") or ("7924841") or ("8842570") or ("8958350") or ("7298691") or ("20130286943") or ("20100322295") or ("8767523") or ("20110182254") or ("8159969") or ("7577085") or ("9148806") or ("8416677") or ("8537703") or ("20130170411") or ("9100275") or ("20100303096") or ("7944851") or ("8165096") or ("9148801") or ("20150304217") or ("20140112225") or ("9191469") or ("20090285164") or ("20140301208") or ("20140050133") or ("20140161126") or ("20140140358") or ("20100050054") or ("20140233551") or ("8464138") or ("20120327987") or ("20130287045") or ("20140198780") or ("7577122") or ("20130272309") or ("20140211678") or ("20130138982") or ("20100265999") or ("20150319272") or ("20150016426") or ("20130235860") or ("9049155") or ("7849391") or ("9210611") or ("7415661") or ("20050195765") or ("20100061320") or ("7512185") or ("20150016360") or ("7062703") or ("8467331") or ("20150023288") or ("20060193277") or ("20080273536") or ("20140369263") or ("20120189042") or ("20090041134") or ("8023593") or ("9071990") or ("8897298") or ("20140071997") or ("8488442") or ("20130107895") or ("8576882") or ("20060023802") or ("7881237") or ("8797836") or ("8498350") or ("20070286066") or ("20090141668") or	US-PGPUB; USPAT	OR	OFF	2015/12/16 07:21

("20140341066") or ("20120250796") or ("20140233478") or ("20130016651") or ("20140269559") or ("20130265920") or ("8576938") or ("20140269659") or ("20110280329") or ("8385308") or ("20100118772") or ("9100072") or ("8781016") or ("20140079145") or ("20060212773")).PN. or (("20140198805") or ("9112753") or ("20150146607") or ("20110280261") or ("20120257606") or ("20150131530") or ("20110286404") or ("20110286322") or ("20140307625") or ("9001909") or ("20140219264") or ("20050232139") or ("8964521") or ("20130107912") or ("20150055546") or ("20120027119") or ("20120250668") or ("20120250617") or ("20140254349") or ("20140128066") or ("9191882") or ("9191092") or ("8737189") or ("20060182017") or ("20150124794") or ("9001904") or ("20140029645") or ("20090238293") or ("20140112397") or ("8218661") or ("20100046441") or ("20110268161") or ("20150030101") or ("20080198786") or ("8730878") or ("20110280332") or ("8576753") or ("20150124704") or ("20130223422") or ("20120051361") or ("20110216816") or ("20140006908") or ("20140119351") or ("8693558") or ("8457125") or ("7995672") or ("20150110163") or ("20140071956") or ("8660013") or ("8315235") or ("7995665") or ("20100086013") or ("20100202424") or ("8479076") or ("20130114757") or ("20100189167") or ("20100157907") or ("9008066") or ("8255760") or ("20110038284") or ("20120314711") or ("8774222") or ("20020012343") or ("8958464") or ("20100115372") or ("9066297") or ("8437245") or ("9143290") or ("20010055311") or ("20140146722") or ("20120207140") or ("20110051706") or ("20050169261") or ("20140192985") or ("8948284") or ("7035285") or ("6898204") or ("20150201433") or ("20090312073") or ("8498607") or ("20140146758") or ("20130279389") or ("20130128809") or ("20080031205") or ("20120314744") or ("20110267956") or ("7046746") or ("20110164707") or ("20110268200") or ("20090316815") or ("20060176968") or ("6882634") or ("8576931") or ("20140036775") or ("20020012337") or ("20050094569") or ("20140064262") or ("20130128808") or ("8223867") or ("20030206561") or ("20140348117") or ("20140328435") or ("7426249") or ("20080187136") or ("7433298") or ("20020057713") or ("20080170556") or ("6988236") or ("8804609") or ("20060215626") or ("8966346") or ("20100329195") or ("6950444") or ("9014205") or ("20120054584") or ("20020003792") or ("8761033") or

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		("20120281625") or ("20150304995")).PN. or (("20120307760") or ("9112686") or ("20150289144") or ("20090004984") or ("9001935") or ("20150003379") or ("20030161411") or ("8213367") or ("20090041087") or ("8848763") or ("9088385") or ("20130315184") or ("20070263702") or ("7099413") or ("20070082633") or ("7940852") or ("20150009927") or ("8780798") or ("20020177446") or ("7706247") or ("7620112") or ("8472385") or ("7564863") or ("20130294333") or ("20070097915") or ("7483674") or ("8705655") or ("7876840") or ("7180850") or ("7280607") or ("20060029168") or ("6795485") or ("7653122") or ("20150358193") or ("7626918") or ("20130070692") or ("20110317633") or ("20140307689") or ("20090080575") or ("20140029568") or ("20140119244") or ("20090262700") or ("20150036651") or ("8284732") or ("7609712") or ("20150172949") or ("20150017923") or ("8867469") or ("20130182685") or ("20060008017") or ("20110310856") or ("20070105508") or ("6711122") or ("8660081") or ("20120269287") or ("8615046") or ("20110122846") or ("7184485") or ("9173109") or ("20140241326") or ("20060046659") or ("20070263735") or ("20110110320") or ("20150326347") or ("20110188585") or ("20070086326") or ("7853205") or ("20140126526") or ("20070081505") or ("20050237923") or ("8483086") or ("8718021") or ("9071399") or ("20070110149") or ("20070086327") or ("20050030885") or ("6477210") or ("9100152") or ("20020067755") or ("20070064587") or ("20060212773") or ("8238496") or ("8054897") or ("5278826") or ("6853675") or ("8320320") or ("20120307917") or ("20020159516") or ("8891475") or ("8547911") or ("8902869") or ("20130163530") or ("20070201350") or ("20100195614") or ("20110206147") or ("20110103338") or ("8437245") or ("8089946") or ("7039105") or ("20070121741") or ("20110051706") or ("20130016694") or ("8422465") or ("20090290552") or ("8045991") or ("7599346") or ("8693442") or ("20110211652") or ("7969311") or ("20110182332") or ("7376117") or ("20110103500") or ("8891593") or ("20130163501") or ("8089887") or ("20140269368") or ("20050190715") or ("20130028209") or ("20140119291") or ("20040081191")).PN.				
S20	6	S18 and S19	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/12/16 07:24

			DERWENT; IBM_TDB			
S21	9	S18 and "TXOP"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 07:28
S22	2	("20040179517").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/16 08:46
S23	2	("20070171858").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/16 09:53
S24	16965	((media adj access adj plan) "MAP") near3 frame	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:03
S25	7581	((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S26	252	S24 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S27	170	S24 and S25 and header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S28	96	S24 and S25 and header and (ofdm$1 dmt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:05
S29	2	("20040179517").PN.	US-PGPUB; USPAT; USOCR;	OR	OFF	2015/12/22 07:40

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S31	84	((orthogonal adj frequency adj division adj multiplex$3) or "OFDM") with ((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/26 11:24
S32	41	("20070060149" | "20070177541" | "20070206534" | "20080075058" | "20080084941" | "20080192644" | "20080292015" | "20090196163" | "20100046358" | "20100067589" | "20100091675" | "20100118829" | "20100309834" | "20110002219" | "20110038332" | "20110096796" | "20110096797" | "20110128929" | "20110128947" | "20110310827" | "20120082040" | "20130286959" | "7599332" | "7742390" | "8144647" | "8149811" | "8270909" | "8363578" | "8395997" | "8472383" | "8599803" | "8619907" | "8660497" | "8670399" | "8737405" | "8787338" | "8787385" | "8811203" | "8886755" | "8923118" | "8971350").PN. OR ("9215055").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/26 11:33
S33	16	S32 and ((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/26 11:33

EAST Search History (Interference)

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12/27/2015 2:52:07 PM
C:\Users\sali\Documents\EAST\Workspaces\Case_116_JK_13376856.wsp

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BIB DATA SHEET

CONFIRMATION NO. 7171

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/376,856	02/08/2012	375	2633	5550-87-PUS

APPLICANTS

INVENTORS

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/US10/46088 08/20/2010
which claims benefit of 61/235,909 08/21/2009

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

03/23/2012

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No					
Verified and Acknowledged	/SHAWKAT M ALI/ Examiner's Signature	Initials	MA	8	21	3

ADDRESS

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202
UNITED STATES

TITLE

HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

FILING FEE RECEIVED		
1240	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	2633
				Examiner Name	Ali, Shawkat M.
Sheet	1	of	1	Attorney Docket Number	5550-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] (if known)	Filing Date MM-DD-YYYY	Name of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
/S.A./	1	Official Action (including translation) for Chinese Patent Application No. 201080037081.2, mailed March 23, 2015 (Attorney Ref. No.: 5550-87-PCN)
/S.A./	2	Office Action for European Patent Application No. 10748023.8, mailed Feb. 17, 2015 (Attorney Ref. No.: 5550-87-PEP)

Examiner Signature	/Shawkat Ali/	Date Considered	12/22/2015

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

CPC- SEARCHED		
Symbol	Date	Examiner
H04B1/38, H04B7/155	12/27/2015	/SA/
H04J1/00, H04J3/00, H04J3/24, H04J11/00	12/27/2015	/SA/
H04L1/00, H04L1/08, H04L5/00, H04L12/26, H04L12/43, H04L12/56, H04L12/403, H04L27/28	12/27/2015	/SA/
H04M1/00	12/27/2015	/SA/
H04W4/00, H04W24/00, H04W52/02, H04W72/04, H04W72/12, H04W74/08	12/27/2015	/SA/

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	229,294,328,329,336,338,356,449	12/27/2015	/SA/
375	219,260,267,295,316	12/27/2015	/SA/

SEARCH NOTES		
Search Notes	Date	Examiner
Inventors, Class/Subclass, CPC, Keywords, IEEE and Google Search	12/27/2015	/SA/
Consulted with Daniel Swerdlow regarding nonfunctional descriptive material	12/17/2015	/SA/

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/SHAWKAT M ALI/ Examiner Art Unit 2633	

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	7171
				Examiner Name	ALI, SHAWKAT M
Sheet	1	of	1	Attorney Docket Number	8365-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
	1	Notification to Grant the Patent (including translation) for Chinese Patent Application No. 201080037081.2, mailed Oct. 26, 2015 (Attorney Ref. No.: 8365-87-PCN)

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Acknowledgement Receipt

EFS ID:	24730027
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	8365-87-PUS
Receipt Date:	26-JAN-2016
Filing Date:	08-FEB-2012
Time Stamp:	18:14:40
Application Type:	U.S. National Stage under 35 USC 371

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		IDS_05.pdf	199613 f1ce7cae740c8043840232a4a029737cf8973011	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Form (SB08)	4	4

Warnings:					
Information:					
2	Non Patent Literature	8365-87-PCN_NOA_10-26-2015.pdf	196835 97facd3a37a9af7f7353be229878eee457f60261	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	396448		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:	Group Art Unit: 2633
Joon Bae Kim	Confirmation No.: 7171
Serial No.: 13/376,856	Examiner: Ali, Shawkat M
Filed: February 8, 2012	
Atty File No.: 8365-87-PUS	SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
Entitled: "HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS"	Electronically Submitted

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

Dear Madam:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

☒ Copies of the cited non-patent and/or foreign references are enclosed herewith.

☐ Copies of the cited U.S. patents and/or patent applications are enclosed herewith.

☐ Copies of the cited U.S. patents/unpublished patent applications/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).

☐ Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. _____ filed _____, which is relied upon for an earlier filing date under 35 U.S.C. § 120.

☒ To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English translation/abstracts and/or in the figures, although applicants do not necessarily vouch for the accuracy of the translation.

☐ Examiner's attention is drawn to the following related applications:

- Serial No. _____ filed _____ (Attorney Ref. No. _____)

☐ Other: _____

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents

analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented. Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

FEES

☐	**37 CFR 1.97(b):** No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction): ☐ Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or ☐ Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or ☐ Before the mailing date of a first Office Action on the merits, or ☐ Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114. Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.
☒	**37 CFR 1.97(c):** The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions: (1) a final action under 37 C.F.R. 1.113 or (2) a notice of allowance under 37 C.F.R. 1.311, or (3) an action that otherwise closes prosecution in the application. This Information Disclosure Statement is accompanied by: ☒ A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970. OR ☐ Please charge Deposit Account 19-1970 in the amount of $180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.
☐	**37 CFR 1.97(d):** This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c). ☐ This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e) AND ☐ Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of $180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.

Certification (37 C.F.R. 1.97(e))

(Applicable only if checked)

☒ The undersigned certifies that:

☒ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(1).

☒ A copy of the communication from the foreign patent office is enclosed.

OR

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: January 26, 2016

By: /Jason H. Vick/

Jason H. Vick
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
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 displays a valid OMB control number.

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(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 62574

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 assignments documents attached to this form in accordance with 37 CFR 3.73(c).

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

☒ The address associated with Customer Number: 62574

OR

☐	Firm or Individual Name			
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: APPLIED TRANSFORM, LLC
805 Las Cimas Parkway, Suite 240
Austin, Texas 78746

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, 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	Mark Roche	Date	1/19/16
Name	Mark Roche	Telephone	
Title	Managing Director		

This collection of information is required by 37 CFR 1.31, 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:	25245101
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	8365-87-PUS
Receipt Date:	18-MAR-2016
Filing Date:	08-FEB-2012
Time Stamp:	17:04:06
Application Type:	U.S. National Stage under 35 USC 371

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	Miscellaneous Incoming Letter	Submission_of_Updated_ADS.pdf	64112 5b924c4e89354a91deb27fcafc18431a5b70d5f7	no	1

Warnings:	
Information:	

2	Application Data Sheet	UPDATED_ADS.pdf	81580 c4119701853acf91e8c04a487579d04f287ca495	no	5
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3		Statement_under_373c_w_POA.pdf	117834 f2fd07e34b0ed8515bd14236a18082c122710c57	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Assignee showing of ownership per 37 CFR 3.73	1	2
	Power of Attorney	3	3

Warnings:	
Information:	
Total Files Size (in bytes):	263526

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	)	Group Art Unit: 2633
Application No.: 13/376,856	)	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	)	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	)	

For: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

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

SUBMISSION OF UPDATED APPLICATION DATA SHEET

Dear Madam:

Attached herewith is an Updated Application Data Sheet updating the Assignee/Applicant in the referenced application.

The Commissioner is hereby authorized to charge to Deposit Account No. 19-1970 any fees under 37 C.F.R. §§ 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby Petitioned.

Respectfully submitted,
SHERIDAN ROSS P.C.

By: /Jason H. Vick/
Jason H. Vick
Registration No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202-5141
(303) 863-9700

Date: March 18, 2016

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	~~5550-87-PUS~~ 8365-87-PUS
	Application Number	13/376,856
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

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.)

Applicant Information:

Applicant 1

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Joon	Bae	KIM	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Lexington	State/Province	MA	Country of Residence	US

Citizenship under 37 CFR 1.41(b) KR

Mailing Address of Applicant:

Address 1	14 Pine Knoll Road		
Address 2			
City	Lexington	State/Province	MA
Postal Code	02420	Country	US

Applicant 2

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Marcos	C.	TZANNES	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Orinda	State/Province	CA	Country of Residence	US

Citizenship under 37 CFR 1.41(b) US

Mailing Address of Applicant:

Address 1	121 La Espiral		
Address 2			
City	Orinda	State/Province	CA
Postal Code	94563	Country	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.**

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~5550-87-PUS~~ 8365-87-PUS
	Application Number	13/376,856
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

Customer Number	62574		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS		
Attorney Docket Number	~~5550-87-PUS~~ 8365-87-PUS	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	8	Suggested Figure for Publication (if any)	1

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).
Enter either 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	62574		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this 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(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	a 371 of international	PCT/US2010/046088	2010-08-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/US2010/046088	non provisional of	61/235909	2009-08-21

UPDATED APPLICATION DATA SHEET

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. 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	~~5550-87-PUS~~ 8365-87-PUS
	Application Number	13/376,856
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

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 benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. 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(a).

Remove

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			(•) Yes ( ) No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Assignee Information:

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

Assignee 1

If the Assignee is an Organization check here. ☒

Organization Name	~~AWARE, INC.~~ APPLIED TRANSFORM, LLC		
Mailing Address Information:			
Address 1	~~40 Middlesex Turnpike~~ 805 LAS CIMAS PARKWAY		
Address 2	SUITE 240		
City	~~Bedford~~ AUSTIN	**State/Province**	~~MA~~ TX
Country	US	Postal Code	~~01730-1432~~ 78746
Phone Number		Fax Number	
Email Address			

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

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jason H. Vick/			Date (YYYY-MM-DD)	2016-03-18
First Name	Jason H.	Last Name	VICK	Registration Number	45285

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. 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	~~5550-87-PUS~~ 8365-87-PUS
	Application Number	13/376,856
Title of Invention	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	

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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: APPLIED TRANSFORM, LLC

Application No./Patent No.: 13/376,856 Filed/Issue Date: February 8, 2012

Titled: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

APPLIED TRANSFORM, 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: Joon Bae Kim and Marcos Tzannes To: AWARE, INC.

   The document was recorded in the United States Patent and Trademark Office at
   Reel 028591, Frame 0605, or for which a copy thereof is attached.

2. From: AWARE, INC. To: APPLIED TRANSFORM, LLC

   The document was recorded in the United States Patent and Trademark Office at
   Reel 037491, Frame 0053, or for which a copy thereof is attached.

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.

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STATEMENT UNDER 37 CFR 3.73(c)

3. 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.

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.

/Jason H. Vick/	March 18, 2016
Signature	Date
Jason H. Vick	45285
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

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
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS

CONFIRMATION NO. 7171

POA ACCEPTANCE LETTER

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

OC000000081798880

Date Mailed: 03/30/2016

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/18/2016.

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**.

/nhassani/

UNITED STATES PATENT AND TRADEMARK OFFICE

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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
13/376,856	02/08/2012	2633	1240	8365-87-PUS	22	3

CONFIRMATION NO. 7171

CORRECTED FILING RECEIPT

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

OC000000081798900

Date Mailed: 03/30/2016

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)

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

Applicant(s)

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

Assignment For Published Patent Application

APPLIED TRANFORM, LLC, AUSTIN, TX

Power of Attorney: The patent practitioners associated with Customer Number 62574

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/US10/46088 08/20/2010
which claims benefit of 61/235,909 08/21/2009

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: No

Permission to Access Search Results: No

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: 03/23/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/376,856**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

Preliminary Class

375

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

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 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).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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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 AssetsControl, 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).

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	)	Group Art Unit: 2633
Application No.: 13/376,856	)	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	)	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	)	

For: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

AMENDMENT AND RESPONSE

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

Madam:

Applicants submit this Amendment and Response to address the Non-Final Office Action having a mailing date of December 31, 2015. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

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

Remarks begin on page 6 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-18. (Cancelled)

19. (Currently Amended) ~~An~~A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver capable of:

~~transmitting or~~ receiving, by a receiver, ~~a Media Access Plan (MAP)~~ a first packet ~~frame comprising a Transmission Opportunity (TXOP) descriptor, wherein the TXOP descriptor contains a bit field that indicates a value for an integer, D, wherein the integer D indicates~~ comprising a first number of OFDM symbols that carry header bits; and ~~transmitting or~~

receiving, by the receiver, a second packet comprising a ~~frame having a plurality of header bits using D OFDM symbols, wherein each of the D~~second number of OFDM symbols that carry ~~the plurality of~~ header bits,

wherein the first number of OFDM symbols is greater than the second number of OFDM symbols,

wherein the first packet is received in a first frequency band,

wherein the second packet is received in a second frequency band, wherein the second frequency band is wider than the first frequency band, and

wherein the first number of OFDM symbols provides frequency diversity by repeating at least one header bit on a plurality of subcarriers.

20-65. (Cancelled)

66. (New) The wireless transceiver of clam 19, wherein the wireless transceiver is also operable to detect that the first packet comprises the first number of OFDM symbols prior to decoding the first number of OFDM symbols.

67. (New) The wireless transceiver of clam 19, wherein the wireless transceiver is also operable to detect that the second packet comprises the second number of OFDM symbols prior to decoding the second number of OFDM symbols.

68. (New) The wireless transceiver of clam 19, wherein the first and second frequency bands are overlapping.

69. (New) The wireless transceiver of clam 19, wherein a first OFDM symbol of the first number of OFDM symbols contains different header bits than a second OFDM symbol of the first number of OFDM symbols.

70. (New) The wireless transceiver of clam 19, wherein a first OFDM symbol of the first number of OFDM symbols contains the same header bits as a second OFDM symbol of the first number of OFDM symbols.

71. (New) The wireless transceiver of clam 19, wherein wireless transceiver supports SmartGrid applications.

72. (New) The wireless transceiver of clam 19, wherein the wireless transceiver supports IEEE 802.11 protocols.

73. (New) A wireless transceiver comprising a receiver and a demodulator operable to:

receive, by the receiver, a first packet in a first frequency band wherein the first packet comprises a first header portion received on a first plurality of OFDM symbols,

receive, by the receiver, a second packet in a second frequency band, wherein the second frequency band is wider than the first frequency band, and wherein the second packet comprises a second header portion received on a second plurality of OFDM symbols,

wherein the first plurality of symbols is greater than the second plurality of symbols, and

wherein the first plurality of symbols provides frequency diversity by repeating at least one header bit on a plurality of subcarriers.

74. (New) The wireless transceiver of clam 73, wherein the wireless transceiver is also operable to detect that the first packet comprises the first header portion with the first plurality of OFDM symbols prior to decoding the first header portion.

75. (New) The wireless transceiver of clam 73, wherein the wireless transceiver is also operable to detect that the second packet comprises the second header portion with the second plurality of OFDM symbols prior to decoding the second header portion.

76. (New) The wireless transceiver of clam 73, wherein the first and second frequency bands are overlapping.

77. (New) The wireless transceiver of clam 73, wherein a first OFDM symbol of the first plurality of OFDM symbols contains different header bits than a second OFDM symbol of the first plurality of OFDM symbols.

78. (New) The wireless transceiver of clam 73, wherein a first OFDM symbol of the first plurality of OFDM symbols contains the same header bits as a second OFDM symbol of the first plurality of OFDM symbols.

79. (New) The wireless transceiver of clam 73, wherein wireless transceiver supports SmartGrid applications.

80. (New) The wireless transceiver of clam 73, wherein the wireless transceiver supports IEEE 802.11 protocols.

81. (New) A wireless transceiver comprising a transmitter and a modulator operable to:

transmit, by the transmitter, a first packet in a first frequency band wherein the first packet comprises a first header portion transmitted on a first plurality of OFDM symbols; and

transmit, by the transmitter, a second packet in a second frequency band, wherein the second frequency band is wider than the first frequency band and wherein the second packet comprises a second header portion transmitted on a second plurality of OFDM symbols,

wherein the first plurality of symbols is greater than the second plurality of symbols, and

wherein the first plurality of symbols provides frequency diversity by repeating transmission of at least one header bit on a plurality of subcarriers.

82. (New) The wireless transceiver of clam 81, wherein the first and second frequency bands are overlapping.

83. (New) The wireless transceiver of clam 81, wherein a first OFDM symbol of the first plurality of OFDM symbols contains different header bits than a second OFDM symbol of the first plurality of OFDM symbols.

84. (New) The wireless transceiver of clam 81, wherein a first OFDM symbol of the first plurality of OFDM symbols contains the same header bits as a second OFDM symbol of the first plurality of OFDM symbols.

85. (New) The wireless transceiver of clam 81, wherein wireless transceiver supports SmartGrid applications.

86. (New) The wireless transceiver of clam 81, wherein the wireless transceiver supports IEEE 802.11 protocols.

REMARKS

Applicant respectfully requests reconsideration of this application as amended.

By this amendment a number of claims are cancelled without prejudice or disclaimer thereby rendering moot a number of the rejections.

Claim 19 recites, inter alia, … receiving, by a receiver, a first packet comprising a first number of OFDM symbols that carry header bits; and

receiving, by the receiver, a second packet comprising a second number of OFDM symbols that carry header bits,

wherein the first number of OFDM symbols is greater than the second number of OFDM symbols,

wherein the first packet is received in a first frequency band,

wherein the second packet is received in a second frequency band, wherein the second frequency band is wider than the first frequency band, and

wherein the first number of OFDM symbols provides frequency diversity by repeating at least one header bit on a plurality of subcarriers.

Yamamoto and Nanda at least fail to teach, suggest or disclose the above combination of features.

As such, Applicant respectfully requests the withdrawal of the 35 U.S.C. §103 rejection.

With comparable arguments being applicable to claims with similar features, Applicant respectfully submits all claims are distinguishable from the references.

With all objections and rejections having been overcome, Applicant respectfully submits the application is in condition for allowance.

A prompt notice of allowance is respectfully solicited.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby Petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: March 30, 2016

By: /Jason H. Vick/

Jason H. Vick
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

Electronic Acknowledgement Receipt

EFS ID:	25353455
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	8365-87-PUS
Receipt Date:	30-MAR-2016
Filing Date:	08-FEB-2012
Time Stamp:	22:03:40
Application Type:	U.S. National Stage under 35 USC 371

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		AMEND_03.pdf	86039 4e96cf6c0bef258c94990d221a377fc2998a7008	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	7
Warnings:			
Information:			
	Total Files Size (in bytes):	86039	

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/376,856	Filing Date 02/08/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **03/30/2016**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 22	Minus	** 22	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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 number found in the appropriate box in column 1.

LIE
/NINA RATANAVONG/

This collection of information is required by 37 CFR 1.16. 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 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	Group Art Unit: 2633
Application No.: 13/376,856	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	

For: HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS

SUPPLEMENTAL AMENDMENT AND RESPONSE

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

Madam:

Applicants submit this Supplemental Amendment and Response to address the Non-Final Office Action having a mailing date of December 31, 2015. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

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

Remarks begin on page 7 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-18. (Cancelled)

19. (Currently Amended) A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver capable of:

receiving, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry header bits; and

receiving, by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols that carry header bits,

wherein the first number of OFDM symbols is greater than the second number of OFDM symbols,

wherein the first packet is received in a first frequency band,

wherein the second packet is received in a second frequency band, wherein the second frequency band is wider than the first frequency band, ~~and~~

wherein the first and second frequency bands have one or more overlapping frequency regions, and

wherein ~~the first number of OFDM symbols provides frequency diversity by repeating~~ at least one header bit in the first packet is repeated on a plurality of OFDM subcarriers.

20-65. (Cancelled)

66. (Previously Presented) The wireless transceiver of clam 19, wherein the wireless transceiver is also operable to detect that the first packet comprises the first number of OFDM symbols prior to decoding the first number of OFDM symbols.

67. (Previously Presented) The wireless transceiver of clam 19, wherein the wireless transceiver is also operable to detect that the second packet comprises the second number of OFDM symbols prior to decoding the second number of OFDM symbols.

68. (Currently Amended) The wireless transceiver of clam 19, wherein the ~~first and~~ second frequency band is one of: two times wider, four times wider and eight times wider than the first frequency band~~bands are overlapping~~.

69. (Currently Amended) The wireless transceiver of clam 19, wherein a first OFDM symbol in the first packet~~of the first number of OFDM symbols~~ contains different header bits than a second OFDM symbol in the first packet~~of the first number of OFDM symbols~~.

70. (Currently Amended) The wireless transceiver of clam 19, wherein a first OFDM symbol in the first packet~~of the first number of OFDM symbols~~ contains the same header bits as a second OFDM symbol in the first packet~~of the first number of OFDM symbols~~.

71. (Previously Presented) The wireless transceiver of clam 19, wherein wireless transceiver supports SmartGrid applications.

72. (Previously Presented) The wireless transceiver of clam 19, wherein the wireless transceiver supports IEEE 802.11 protocols.

73. (Currently Amended) A wireless transceiver comprising a receiver ~~and a demodulator~~ operable to:

receive, by the receiver using wireless OFDM communications, a first packet in a first frequency band wherein the first packet comprises a first header portion received on a first number~~plurality~~ of OFDM symbols;,

receive, by the receiver using wireless OFDM communications, a second packet in a second frequency band, wherein the second frequency band is wider than the first frequency band, and wherein the second packet comprises a second header portion received on a second number~~plurality~~ of OFDM symbols,

wherein the first and second frequency bands have one or more overlapping frequency regions.

wherein the first numberplurality of symbols is greater than the second numberplurality of symbols, and

wherein the first plurality of symbols provides frequency diversity by repeating at least one header bit in the first packet is repeated on a plurality of OFDM subcarriers.

74. (Currently Amended) The wireless transceiver of clam 73, wherein the wireless transceiver is also operable to detect that the first packet comprises the first header portion with the first numberplurality of OFDM symbols prior to decoding the first header portion.

75. (Currently Amended) The wireless transceiver of clam 73, wherein the wireless transceiver is also operable to detect that the second packet comprises the second header portion with the second numberplurality of OFDM symbols prior to decoding the second header portion.

76. (Currently Amended) The wireless transceiver of clam 73, wherein the first and second frequency band is one of, two times wider, four times wider and eight times wider than the first frequency bandbands are overlapping.

77. (Currently Amended) The wireless transceiver of clam 73, wherein a first OFDM symbol in the first packetof the first plurality of OFDM symbols contains different header bits than a second OFDM symbol in the first packetof the first plurality of OFDM symbols.

78. (Currently Amended) The wireless transceiver of clam 73, wherein a first OFDM symbol in the first packetof the first plurality of OFDM symbols contains the same header bits as a second OFDM symbol in the first packetof the first plurality of OFDM symbols.

79. (Previously Presented) The wireless transceiver of clam 73, wherein wireless transceiver supports SmartGrid applications.

80. (Previously Presented) The wireless transceiver of clam 73, wherein the wireless transceiver supports IEEE 802.11 protocols.

81-86. (Cancelled)

87. (New) A wireless transceiver operable to:

receive a packet, using wireless OFDM communications, in one of a first frequency band and a second frequency band, wherein the packet comprises a header portion received on a number of OFDM symbols; and

decode the header portion, wherein the number of OFDM symbols in the header portion for the packet received in the first frequency band is greater the number of OFDM symbols in the header portion for the packet received in the second frequency band,

wherein the first and second frequency bands have one or more overlapping frequency regions,

wherein the second frequency band is wider than the first frequency band, and

wherein at least one header bit is repeated on a plurality of OFDM subcarriers in the first frequency band.

88. (New) The wireless transceiver of claim 87, wherein a first OFDM symbol of the packet contains different header bits than a second OFDM symbol of the packet.

89. (New) The wireless transceiver of claim 87, wherein a first OFDM symbol of the packet contains the same header bits as a second OFDM symbol of the packet.

90. (New) The wireless transceiver of claim 87, wherein the wireless transceiver supports SmartGrid applications.

91. (New) The wireless transceiver of claim 87, wherein the wireless transceiver supports IEEE 802.11 protocols.

92. (New) The wireless transceiver of claim 87, wherein the second frequency band is one of: two times wider, four times wider and eight times wider than the first frequency band.

REMARKS

Applicant respectfully requests reconsideration of this application as amended.

By this amendment, and further to Applicant's March 30, 2016 response, Applicant has further clarified the claims.

Applicant believes that at least based on the previously filed comments that all claims are in condition for allowance.

With all objections and rejections having been overcome, Applicant respectfully submits the application is in condition for allowance.

A prompt notice of allowance is respectfully solicited.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby Petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: May 17, 2016

By: /Jason H. Vick/

Jason H. Vick
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

Electronic Acknowledgement Receipt

EFS ID:	25806720
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	8365-87-PUS
Receipt Date:	17-MAY-2016
Filing Date:	08-FEB-2012
Time Stamp:	19:06:39
Application Type:	U.S. National Stage under 35 USC 371

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		AMEND_03_SUPP.pdf	92336 3ebd58c7356c1211bed42461c6cc74cdc98807be	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Supplemental Response or Supplemental Amendment	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	7
Warnings:			
Information:			
	Total Files Size (in bytes):	92336	

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

USPTO Automated Interview Request (AIR)

May 17 2016

This paper requesting to schedule and/or conduct an interview is appropriate because:

This submission is requested to be accepted as an authorization for this interview to communicate via the internet. Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned concerning scheduling of the interview via video conference, instant messaging, or electronic mail, and to conduct the interview in accordance with office practice including video conferencing.

Name(s):
Jason H Vick

S-signature:
/Jason H Vick/

Registration Number:
45285

U.S. Application Number:
13376856

Confirmation Number:
7171

E-mail Address:
jvick@SHERIDANROSS.COM

Phone Number:
3037643005

Proposed Time of Interview:
6-8-2016 1:00 PM ET

Prefered Interview Type:
In-person

I am the applicant or applicant's representative for this application.

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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

62574 7590 06/20/2016

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

NOTIFICATION DATE	DELIVERY MODE
06/20/2016	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):

jvick@sheridanross.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/376,856	KIM ET AL.	
	Examiner	Art Unit	
	SHAWKAT M. ALI	2633	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SHAWKAT M. ALI*. (3)_____.

(2) *JASON H. VICK (Attornney)*. (4)*MARCOS TZANNES (Inventor)*.

Date of Interview: *08 June 2016*.

Type: ☐ Telephonic ☐ Video Conference
☒ Personal [copy given to: ☐ applicant ☒ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *All*.

Identification of prior art discussed: *None*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant and undersigne representaive conducted an in-person interview with the Examiner. The interview generally pertained to independent claims. Amendment filed on 05/17/2016 was discussed. Although no agreement was reached at this time, Examiner will conduct another interview in order to expedite the prosecution before issuing an Office Action.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SHAWKAT M ALI/ Examiner, Art Unit 2633	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

62574 7590 08/18/2016

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

NOTIFICATION DATE	DELIVERY MODE
08/18/2016	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):

jvick@sheridanross.com

Office Action Summary	Application No. 13/376,856	Applicant(s) KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05/17/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *19,66-80 and 87-92* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *19,66-80 and 87-92* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ 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)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Status of Claims

2. This communication is response to the Supplemental Amendment filed on May 17, 2016.

3. Claims 19, 66-80 and 87-92 are currently pending; claims 19, 68-70 & 73-78 have been amended; and claim 87-92 have been added.

Examiner Interview

4. Examiner thanks the Applicant representative Mr. Vick for the interview conducted on August 11, 2016. During the interview Examiner requested Applicant representative to clarify the support for all the wherein clauses in the independent claims submitted on 03/30/2016 (Amendment After Non-Final) and 05/17/2016 (Supplemental Amendment). However, Applicant representative indicated that he will need to consult with the inventors and suggested that the Office should issue an Action with 35 U.S.C 112(a) rejection. Furthermore, during the interview Examiner notified the Applicant representative that since in the independent claims 19, 73 and 87 (Supplemental Amendment) the packets are not being used to make any decision (e.g. decoding/demodulating), these packets are non-functional descriptive materials and, therefore, lack patentable weight. In response, Applicant representative informed that upon receiving an

Action form the Office, Applicant will submit another version of claims amendments under AFCP 2.0.

Information Disclosure Statement (IDS)

5. The IDS submitted on 01/26/2016 has been entered and considered by the Examiner.

Response to Arguments

6. Applicant's arguments, filed on 03/30/2016, with respect to objections and rejections have been fully considered and are persuasive. Therefore, the objections and rejections have been withdrawn. However, Applicant's amendment necessitated the new grounds of rejection presented below.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 19, 66-80 and 87-92 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 19 recites multiples wherein clauses on lines 7-15. However, the Specification is appeared to be silent on these wherein clauses. Please refer to the above "*Examiner Interview*" Section 4. Similar rejection applies to independent claims 73 and 87.

In addition, claims 66-72, claims 74-80 and claims 88-92 that depend on claims 19, 73 and 87 respectively consider to be new subject matters as claims 19, 73 and 87 do not comply with 35 USC 112, first paragraph.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure. Ma (US 2003/0072255 A1) discloses in Figure 2B transmitting and receiving a first packet (Slot 1) with a first number of OFDM symbols that carry header bits and a second packet (Slot 2) with a second number of OFDM symbols that carry header bits.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to SHAWKAT M. ALI whose telephone number is (571) 270-1639. The Examiner can normally be reached on Monday-Thursday 9:00AM-4:30PM EST.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's Supervisor, SAM K. AHN can be reached on (571) 272-3044. 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.

/SHAWKAT M ALI/

Examiner, Art Unit 2633

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	13/376,856	KIM ET AL.	
	Examiner	Art Unit	
	SHAWKAT M. ALI	2633	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SHAWKAT M. ALI*. (3)_____.

(2) *JASON H. VICK*. (4)_____.

Date of Interview: *11 August 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☒112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *19, 73 and 87*.

Identification of prior art discussed: *Ma (US 2003/0072255 A1)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Claims 19, 73 and 87 have been discussed as set forth in the Final Office Action in Section 4.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SHAWKAT M ALI/ Examiner, Art Unit 2633	

Notice of References Cited	Application/Control No. 13/376,856	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2003/0072255 A1	04-2003	Ma, Jianglei	H04B7/022	370/208
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/376,856
				Filing Date	February 8, 2012
				First Named Inventor	Joon Bae Kim
				Art Unit	7171
				Examiner Name	ALI, SHAWKAT M
Sheet	1	of	1	Attorney Docket Number	8365-87-PUS

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number-kind Code [2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]; Number[4]; Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No.[1]	
/S.A./	1	Notification to Grant the Patent (including translation) for Chinese Patent Application No. 201080037081.2, mailed Oct. 26, 2015 (Attorney Ref. No.: 8365-87-PCN)

Examiner Signature	/Shawkat Ali/	Date Considered	08/12/2016

*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	(13/376856).APP.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/06/06 10:59
S2	2601	((Joon) near2 (Kim)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:11
S3	237	((Marcos) near2 (Tzannes)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:12
S4	2832	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:12
S5	3	S4 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:13
S6	28058	(370/338,356,458,468).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S7	16810	(375/219,260).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S8	44525	S6 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S9	158	S8 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2014/06/11 09:51

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S10	80	S8 and "OFDM" and ("TXOP" same ("MAC" "MAP"))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52
S11	45	S10 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52
S13	467	beacon near2 header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/10 11:46
S14	21	"OFDM" same "TXOP" same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 15:35
S15	325	"TXOP" with bit	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
S16	3069	"OFDM" same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
S17	26	S15 and S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
S18	250	(("20120275528") or ("20140233615") or ("8718118") or ("20150188742") or ("8953657") or ("9154355") or ("8537796") or ("20110080963") or ("20110110437") or ("20130336182") or ("20120189072") or ("20110216814") or ("20140119410") or ("8472537") or ("20120057483") or ("20040047296") or ("20130202017") or ("20080049601") or ("7522514") or	US-PGPUB; USPAT	OR	OFF	2015/12/16 07:21

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S20	6	S18 and S19	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 07:24
S21	9	S18 and "TXOP"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 07:28
S22	2	("20040179517").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/16 08:46
S23	2	("20070171858").PN.	US-PGPUB;	OR	OFF	2015/12/16

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			09:53
S24	16965	((media adj access adj plan) "MAP") near3 frame	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:03
S25	7581	((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S26	252	S24 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S27	170	S24 and S25 and header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S28	96	S24 and S25 and header and (ofdm$1 dmt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:05
S29	2	("20040179517").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/22 07:40
S31	84	((orthogonal adj frequency adj division adj multiplex$3) or "OFDM") with ((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/26 11:24
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S33	16	S32 and ((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/26 11:33
S34	31	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same ((transmission adj opportunity) or txop) same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:03
S35	10	("20050226204" | "20050254465" | "20060018268" | "20070058575" | "20080036909" | "20080181155" | "20090040965" | "7324605").PN. OR ("8817698").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 11:22
S36	73	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same ((transmission adj opportunity) or txop) same (header packet peamble)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:39
S37	42	S36 not S34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:39
S38	8	S37 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:40
S39	19	("20030016686" | "20050055406" | "20050147034" | "20050175014" | "20060168313" | "6426943" | "6473425" | "6606301" | "6832261" | "6959002" | "7310337" | "7457313" | "7580355").PN. OR ("8139593").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 11:51
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S41	28065	(375/219,260,267,295,316).ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:26
S42	2815	(H04B1/38 H04B7/155).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:27
S43	1559	(H04J1/00 H04J3/00 H04J3/24 H04J11/00).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:28
S44	8852	(H04L1/00 H04L1/08 H04L5/00 H04L12/26 H04L12/43 H04L12/56 H04L12/403 H04L27/28).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:30
S45	440	(H04M1/00).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:31
S47	22074	(H04W4/00 H04W24/00 H04W52/02 H04W72/04 H04W72/12 H04W74/08).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:33
S48	117614	S40 S41 S42 S43 S44 S45 S47	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:33
S49	37065	S48 and ofdm$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:33
S50	503	S49 and (((transmission adj opportunity) or txop) same (header packet peamble))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:34
S51	244	S49 and (((transmission adj opportunity) or txop) same (header peamble))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:34
S52	37	S51 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:35
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S54	761	S48 and ofdm$1 and ((transmission adj opportunity) or txop) and header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:18

S55	186	S54 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:18
S56	149	S55 not (S34 S38 S52)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:19
S57	141	S56 and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:20
S58	130	S56 and ("MAC" "MAP") and frame	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:20
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S61	405	ofdm with packet with header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/07 15:59
S62	55	S61 and overlapp$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/07 16:00

EAST Search History (Interference)

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015	12/23/2015	08/12/2016	08/12/2016				
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	20	-	-	-	-					
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	22	-	-	-	-					
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	24	✓	✓	✓	-					
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	27	-	-	-	-					
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	29	✓	✓	✓	-					
	30	✓	✓	✓	-					
	31	-	-	-	-					
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	34	-	-	-	-					
	35	✓	✓	✓	-					
	36	-	-	-	-					
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	38	✓	✓	✓	-					
	39	-	-	-	-					
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	42	✓	✓	✓	-					
	43	-	-	-	-					
	44	-	-	-	-					
	45	-	-	-	-					
	46	-	-	-	-					
	47	✓	✓	✓	-					
	48	✓	✓	✓	-					
	49	-	-	-	-					
	50	-	-	-	-					
	51	-	-	-	-					
	52	-	-	-	-					
	53	✓	✓	✓	-					
	54	-	-	-	-					

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015	12/23/2015	08/12/2016	08/12/2016				
	55	-	-	-	-					
	56	✓	-	-	-					
	57	-	-	-	-					
	58	-	-	-	-					
	59	-	-	-	-					
	60	✓	✓	✓	-					
	61	✓	✓	✓	-					
	62	✓	✓	✓	-					
	63	✓	✓	✓	-					
	64	✓	✓	✓	-					
	65	✓	✓	✓	-					
	66				✓					
	67				✓					
	68				✓					
	69				✓					
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	80				✓					
	81				-					
	82				-					
	83				-					
	84				-					
	85				-					
	86				-					
	87				✓					
	88				✓					
	89				✓					
	90				✓					

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	**Art Unit**
	SHAWKAT M ALI	2633

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	06/05/2014	02/10/2015	12/23/2015	08/12/2016	08/12/2016				
	91				✓					
	92				✓					

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. 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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/376,856	Filing Date 02/08/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	08/23/2016	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 32	Minus	** 22	= 10	X $80 =	800
	Independent (37 CFR 1.16(h))	* 4	Minus	***3	= 1	X $420 =	420
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	1220

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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 number found in the appropriate box in column 1.

LIE
MARCIA GORDON

This collection of information is required by 37 CFR 1.16. 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 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	Group Art Unit: 2633
Application No.: 13/376,856	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	

For: A METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

AMENDMENT AFTER FINAL

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

Madam:

Applicants submit this Amendment After Final to address the Final Office Action having a mailing date of August 18, 2016. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Abstract begin on page 3 of this paper.

Amendments to the Claims are shown in the listing of claims which begins on page 5 of this paper.

Remarks begin on page 12 of this paper.

Amendments to the Specification:

In the title:

Please change the title to read as follows:

A METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS~~PACKET-BASED~~ OFDM ~~SYSTEMS~~NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

AMENDMENTS TO THE ABSTRACT

Please amend the Abstract as follows:

~~An OFDM communication system is described that allows different values of D in a single domain where nodes are operating in different portions of frequency bands. For the power-line medium, G.9960 has defined two overlapped baseband bandplans, 50MHz-PB and 100MHz-PB. In this exemplary scenario, the level of frequency diversity is different depending on the bandplan, hence providing different header decodibility if D is fixed to 1. If D is fixed to 2, then it increases reliability for the narrowband devices, but may also unnecessarily increase overhead for the wide-band devices. An exemplary aspect is therefore directed to techniques to accommodate different repetitions schemes (D = 1,…., DMAX and H = 1,…., HMAX) in a single domain, and still allow devices to communicate with one another where DMAX and HMAX can be larger than 2.~~ Method and apparatus for use within a wireless OFDM network that transmits and receives first and second packets each having header bits and utilizing variable header repetition. The header bits in the first packet are communicated on multiple OFDM symbols and repeated on a plurality of OFDM subcarriers in a first frequency band. The header bits in a second packet are communicated on fewer OFDM symbols and in a second frequency band that overlaps with and is wider than the first frequency band.

ABSTRACT

Method and apparatus for use within a wireless OFDM network that transmits and receives first and second packets each having header bits and utilizing variable header repetition. The header bits in the first packet are communicated on multiple OFDM symbols and repeated on a plurality of OFDM subcarriers in a first frequency band. The header bits in a second packet are communicated on fewer OFDM symbols and in a second frequency band that overlaps with and is wider than the first frequency band.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-18. (Cancelled)

19. (Currently Amended) A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver ~~capable of~~operable to:

~~receiving~~receive, in a first frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulate, by a demodulator connected to and in communication with the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the plurality of header bits is repeated on a plurality of OFDM subcarriers; ~~and~~

~~receiving~~receive, in a second frequency band wider than the first frequency band, and by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits; ~~, and~~

demodulate, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

~~wherein the first number of OFDM symbols is greater than the second number of OFDM symbols,~~

~~wherein the first packet is received in a first frequency band,~~

~~wherein the second packet is received in a second frequency band, wherein the second frequency band is wider than the first frequency band,~~

wherein the first and second frequency bands have one or more overlapping frequency regions~~, and~~

~~wherein at least one header bit in the first packet is repeated on a plurality of OFDM subcarriers.~~

20-65. (Cancelled)

66. (Currently Amended) The wireless transceiver of clam 19, wherein the at least one repeated header bit increases the reliability of the first packet in the first, narrower frequency band~~the wireless transceiver is also operable to detect that the first packet comprises the first number of OFDM symbols prior to decoding the first number of OFDM symbols.~~

67. (Currently Amended) The wireless transceiver of clam 19, wherein the at least one repeated header bit provides additional diversity to increase the likelihood of correctly decoding header information of the first packet in the first, narrower frequency band~~the wireless transceiver is also operable to detect that the second packet comprises the second number of OFDM symbols prior to decoding the second number of OFDM symbols.~~

68. (Previously Presented) The wireless transceiver of clam 19, wherein the second frequency band is one of: two times wider, four times wider and eight times wider than the first frequency band.

69. (Previously Presented) The wireless transceiver of clam 19, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

70. (Previously Presented) The wireless transceiver of clam 19, wherein a first OFDM symbol in the first packet contains the same header bits as a second OFDM symbol in the first packet.

71. (Currently Amended) The wireless transceiver of clam 19, wherein the wireless transceiver supports SmartGrid applications.

72. (Currently Amended) The wireless transceiver of clam 19, wherein the wireless transceiver supports ~~IEEE 802.11~~ one or more wireless protocols.

73. (Currently Amended) A wireless OFDM transceiver comprising ~~a receiver operable to~~:

~~receive~~a wireless OFDM communications receiver operable to receive, ~~by the receiver using wireless OFDM communications,~~ a first packet in a first frequency band wherein the first packet comprises a first header portion received on a first number of OFDM symbols;

a demodulator, connected to the receiver, that demodulates the first number of OFDM symbols to determine the first header portion, wherein at least one header bit of the header portion is repeated on a plurality of OFDM subcarriers;

~~receive~~, the wireless OFDM communications receiver further operable to receive ~~by the receiver using wireless OFDM communications,~~ a second packet in a second frequency band, wherein the second frequency band is wider than the first frequency band, and wherein the second packet comprises a second header portion received on a second number of OFDM symbols, less than the first number of OFDM symbols;

the demodulator further operable to demodulate the second number of OFDM symbols to determine the second header portion,

wherein the first and second frequency bands have one or more overlapping frequency regions.;

~~wherein the first number of symbols is greater than the second number of symbols, and~~

~~wherein at least one header bit in the first packet is repeated on a plurality of OFDM subcarriers.~~

74. (Currently Amended) The wireless transceiver of clam 73, wherein the at least one repeated header bit increases the reliability of the packet in the first, narrower frequency band~~wireless transceiver is also operable to detect that the first packet comprises the first header portion with the first number of OFDM symbols prior to decoding the first header portion~~.

75. (Currently Amended) The wireless transceiver of clam 73, wherein the at least one repeated header bit provides additional diversity to increase the likelihood of correctly

decoding header information of the first packet in the first, narrower frequency bandwireless transceiver is also operable to detect that the second packet comprises the second header portion with the second number of OFDM symbols prior to decoding the second header portion.

76. (Previously Presented) The wireless transceiver of clam 73, wherein the second frequency band is one of: two times wider, four times wider and eight times wider than the first frequency band.

77. (Previously Presented) The wireless transceiver of clam 73, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

78. (Previously Presented) The wireless transceiver of clam 73, wherein a first OFDM symbol in the first packet contains the same header bits as a second OFDM symbol in the first packet.

79. (Currently Amended) The wireless transceiver of clam 73, wherein the wireless transceiver supports SmartGrid applications.

80. (Currently Amended) The wireless transceiver of clam 73, wherein the wireless transceiver supports IEEE 802.11 one or more wireless protocols.

81-86. (Cancelled)

87. (Currently Amended) A method of operating a wireless OFDM transceiver operable to comprising:

receive a packet, using wireless OFDM communications, in one of a first frequency band and a second frequency band, wherein the packet comprises a header portion received on a number of OFDM symbols; and

~~decode the header portion, wherein the number of OFDM symbols in the header portion for the packet received in the first frequency band is greater the number of OFDM symbols in the header portion for the packet received in the second frequency band;~~

~~wherein the first and second frequency bands have one or more overlapping frequency regions;~~

~~wherein the second frequency band is wider than the first frequency band; and~~

~~wherein at least one header bit is repeated on a plurality of OFDM subcarriers in the first frequency band.~~

receiving, in a first frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulating, by a demodulator connected to the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the plurality of header bits is repeated on a plurality of OFDM subcarriers;

receiving, in a second frequency band wider than the first frequency band, by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits; and

demodulating, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

wherein the first and second frequency bands have one or more overlapping frequency regions.

88. (Currently Amended) The ~~wireless transceiver~~ method of claim 87, wherein a first OFDM symbol of the packet contains different header bits than a second OFDM symbol of the packet.

89. (Currently Amended) The ~~wireless transceiver~~ method of claim 87, wherein a first OFDM symbol of the packet contains the same header bits as a second OFDM symbol of the packet.

90. (Currently Amended) The ~~wireless transceiver~~ method of claim 87, wherein the wireless transceiver supports SmartGrid applications.

91. (Currently Amended) The ~~wireless transceiver~~ method of claim 87, wherein the wireless transceiver supports ~~IEEE 802.11~~ one or more wireless protocols.

92. (Currently Amended) The ~~wireless transceiver~~ method of claim 87, wherein the second frequency band is one of: two times wider, four times wider and eight times wider than the first frequency band.

93. (New) The method of claim 87, the at least one repeated header bit increases the reliability of the packet in the first, narrower frequency band.

94. (New) The method of claim 87, wherein the at least one repeated header bit provides additional diversity to increase the likelihood of correctly decoding header information of the first packet in the first, narrower frequency band.

95. (New) A method in a wireless OFDM transceiver comprising:

receiving, by a wireless OFDM communications receiver, a first packet in a first frequency band wherein the first packet comprises a first header portion received on a first number of OFDM symbols;

demodulating, by a demodulator connected to the receiver, the first number of OFDM symbols to determine the first header portion, wherein at least one header bit of the header portion is repeated on a plurality of OFDM subcarriers;

receiving, a second packet in a second frequency band, by the wireless OFDM communications receiver, wherein the second frequency band is wider than the first frequency band, and wherein the second packet comprises a second header portion received on a second number of OFDM symbols, less than the first number of OFDM symbols;

demodulate, by the demodulator, the second number of OFDM symbols to determine the second header portion,

wherein the first and second frequency bands have one or more overlapping frequency regions.

96. (New) The method of claim 95, wherein the at least one repeated header bit increases the reliability of the packet in the first, narrower frequency band.

97. (New) The method of claim 95, wherein the at least one repeated header bit provides additional diversity to increase the likelihood of correctly decoding header information of the first packet in the first, narrower frequency band.

98. (New) The method of claim 95, wherein the second frequency band is one of: two times wider, four times wider and eight times wider than the first frequency band.

99. (New) The method of claim 95, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

100. (New) The wireless method of claim 95, wherein a first OFDM symbol in the first packet contains the same header bits as a second OFDM symbol in the first packet.

101. (New) The method of claim 95, wherein the wireless transceiver supports SmartGrid applications.

102. (New) The method of claim 95, wherein the wireless transceiver supports one or more wireless protocols.

REMARKS

Applicant respectfully requests reconsideration of this application as amended.

Applicant expressly thanks Ex. Ali for the courtesies extended during the recent telephone Interviews. During the Interviews, the above claims were discussed and it was agreed the Examiner could review the claims as part of the attached AFCP 2.0 request.

As requested by the Examiner, support for the above claims can be found at least in paragraphs 3, 4, 6, 7, 8, 9 and Figures 1 and 5 of Applicant's specification.

Without concession as to the propriety of the rejection, Applicant has generally amended the claims based on the Examiner's constructive feedback.

Independent claim 19 now recites:

...receive, in a first frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulate, by a demodulator connected to and in communication with the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the plurality of header bits is repeated on a plurality of OFDM subcarriers;

receive, in a second frequency band wider than the first frequency band, and by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits; and

demodulate, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

wherein the first and second frequency bands have one or more overlapping frequency regions.

Applicant therefore respectfully believes that not only is claim 19 definite, but also that the claim is in full compliance with 35 U.S.C. §112, first paragraph.

Withdrawal of the rejection is respectfully requested.

With comparable arguments being applicable to the other rejected claims, Applicant respectfully submits all claims are in condition for allowance.

Withdrawal of the 35 U.S.C. §112 rejection is respectfully requested.

A prompt Notice of Allowance is respectfully solicited.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby Petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: August 23, 2016

By: /Jason H. Vick/

Jason H. Vick
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
8365-87-PUS	13/376,856	02-08-2012
First Named Inventor:	**Title:**	
Joon Bae Kim	A METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
   - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
   - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
     - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
     - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
       - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
       - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/Jason H. Vick/	August 23, 2016
Name (Print/Typed)	**Practitioner Registration No.**
Jason H. Vick	45,285

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

☑ * Total of 1 forms are submitted.

Electronic Patent Application Fee Transmittal

Application Number:	13376856
Filing Date:	08-Feb-2012
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Filer:	Jason Vick/Joanne Vos
Attorney Docket Number:	8365-87-PUS

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	1615	10	80	800
Independent claims in excess of 3	1614	1	420	420
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1220**

Electronic Acknowledgement Receipt

EFS ID:	26725770
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	8365-87-PUS
Receipt Date:	23-AUG-2016
Filing Date:	08-FEB-2012
Time Stamp:	16:54:32
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1220
RAM confirmation Number	082416INTEFSW00003556191970
Deposit Account	191970
Authorized User	Joanne Vos

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		AMEND_04_AF.pdf	241818 c2e3e09642c49a3f1172fbd74925cf5338a69c5b	yes	14

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Specification	2	2
	Abstract	3	4
	Claims	5	11
	Applicant Arguments/Remarks Made in an Amendment	12	13
	After Final Consideration Program Request	14	14

Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32172 1901b83034bb71a6d1d28e1ed4f45d173e6fe501	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	273990		

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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NOTICE OF ALLOWANCE AND FEE(S) DUE

62574 7590 09/27/2016

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

EXAMINER
ALI, SHAWKAT M

ART UNIT	PAPER NUMBER
2633	

DATE MAILED: 09/27/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

TITLE OF INVENTION: METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	12/27/2016

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: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete 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
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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)

62574 7590 09/27/2016

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

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.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

TITLE OF INVENTION: METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	12/27/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALI, SHAWKAT M	2633	375-219000

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 _____

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

(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. 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. Form PTO-2038 is attached.

❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

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.

❑ Applicant asserting small entity status. See 37 CFR 1.27

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.

❑ Applicant changing to regular undiscounted fee 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.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

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Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

DATE MAILED: 09/27/2016

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 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, 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. 13/376,856	Applicant(s) KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	AIA (First Inventor to File) 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 *08/23/2016*.
   ☐ 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 *19, 66-80 and 87-102 (renumbered as 1-32 respectively)*. 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 a reply 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)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☒ Other *EAST Search History, Updated Bib Data Sheet, Annotated Sheet and PTO 2323*.

/SHAWKAT M ALI/
Examiner, Art Unit 2633

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Examiner's Amendment

2. An Examiner's Amendment to the record appears below. Should the changes and/or additions be unacceptable to Applicant, an Amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an Amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this Examiner's Amendment was given in a telephone interview with Jason H. Vick on September 12, 2016.

3. **The following claims have been replaced as follows:**

Claim 19. A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver operable to:

receive, in a first **narrower** frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulate, by a demodulator connected to and in communication with the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the **first** plurality of header bits **in the first packet** is repeated on a plurality of OFDM subcarriers;

receive, in a second **wider** frequency band ~~**wider than the first frequency band**~~, ~~**and**~~ by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits**, different than the first plurality of header bits**; and

demodulate, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

wherein the first **narrower** and second **wider** frequency bands have one or more overlapping frequency regions.

Claim 66. The wireless transceiver of ~~**clam**~~ **claim** 19, wherein the at least one repeated header bit increases ~~**the**~~ reliability of the first packet in the first~~,~~ narrower frequency band.

Claim 67. The wireless transceiver of ~~**clam**~~ **claim** 19, wherein the at least one repeated header bit provides additional diversity to increase ~~**the**~~ **a** likelihood of correctly decoding header information of the first packet in the first~~,~~ narrower frequency band.

Claim 68. The wireless transceiver of ~~**clam**~~ **claim** 19, wherein the second **wider** frequency band is one of: two times wider, four times wider and eight times wider than the first **narrower** frequency band.

Claim 69. The wireless transceiver of ~~**claim**~~ **claim** 19, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

Claim 70. The wireless transceiver of ~~**claim**~~ **claim** 19, wherein a first OFDM symbol in the first packet contains the ~~**same**~~ **first plurality of** header bits ~~**as**~~ **and** a second OFDM symbol in the first packet **contains the first plurality of header bits**.

Claim 71. The wireless transceiver of ~~**claim**~~ **claim** 19, wherein the wireless transceiver supports SmartGrid applications.

Claim 72. The wireless transceiver of ~~**claim**~~ **claim** 19, wherein the wireless transceiver supports one or more wireless ~~**protocols**~~ **standards**.

Claim 73. A wireless OFDM **(Orthogonal Frequency Division Multiplexing)** transceiver comprising:

a wireless OFDM communications receiver operable to receive a first packet in a first **narrower** frequency band**,** wherein the first packet comprises a first header portion received on a first number of OFDM symbols;

a demodulator, connected to the **wireless OFDM communications** receiver, that demodulates the first number of OFDM symbols to determine the first header portion, wherein at least one header bit of the **first** header portion **in the first packet** is repeated on a plurality of OFDM subcarriers;

the wireless OFDM communications receiver further operable to receive a second packet in a second **wider** frequency band, ~~**wherein the second frequency band is wider than the first frequency band, and**~~ wherein the second packet comprises a second header portion received on a second number of OFDM symbols, less than the first number of OFDM symbols**, and wherein the second header portion different than the first header portion**;

the demodulator further operable to demodulate the second number of OFDM symbols to determine the second header portion,

wherein the first **narrower** and second **wider** frequency bands have one or more overlapping frequency regions.

Claim 74. The wireless transceiver of ~~**clam**~~ **claim** 73, wherein the at least one repeated header bit increases ~~**the**~~ reliability of the **first** packet in the first~~,~~ narrower frequency band.

Claim 75. The wireless transceiver of ~~**clam**~~ **claim** 73, wherein the at least one repeated header bit provides additional diversity to increase ~~**the**~~ **a** likelihood of correctly decoding header information of the first packet in the first~~,~~ narrower frequency band.

Claim 76. The wireless transceiver of ~~**clam**~~ **claim** 73, wherein the second **wider** frequency band is one of: two times wider, four times wider and eight times wider than the first **narrower** frequency band.

Claim 77. The wireless transceiver of ~~**claim**~~ **claim** 73, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

Claim 78. The wireless transceiver of ~~**claim**~~ **claim** 73, wherein a first OFDM symbol in the first packet contains the ~~**same**~~ **first plurality of** header bits ~~**as**~~ **and** a second OFDM symbol in the first packet **contains the first plurality of header bit**s.

Claim 79. The wireless transceiver of ~~**claim**~~ **claim** 73, wherein the wireless transceiver supports SmartGrid applications.

Claim 80. The wireless transceiver of ~~**claim**~~ **claim** 73, wherein the wireless transceiver supports one or more wireless ~~**protocols**~~ **standards**.

Claim 87. A method of operating a wireless OFDM **(Orthogonal Frequency Division Multiplexing)** transceiver comprising:

receiving, in a first **narrower** frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulating, by a demodulator connected to the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the **first** plurality of header bits **in the first packet** is repeated on a plurality of OFDM subcarriers;

receiving, in a second **wider** frequency band ~~**wider than the first frequency band**~~, by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits**, different than the first plurality of header bits**; and

demodulating, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

wherein the first **narrowe**r and second **wider** frequency bands have one or more overlapping frequency regions.

Claim 88. The method of claim 87, wherein a first OFDM symbol of the **first** packet contains different header bits than a second OFDM symbol of the **first** packet.

Claim 89. The method of claim 87, wherein a first OFDM symbol of the **first** packet contains the ~~**same**~~ **first plurality of** header bits ~~**as**~~ **and** a second OFDM symbol of the **first** packet **contains the first plurality of header bits**.

Claim 91. The method of claim 87, wherein the wireless transceiver supports one or more wireless ~~**protocols**~~ **standards**.

Claim 92. The method of claim 87, wherein the second **wider** frequency band is one of: two times wider, four times wider and eight times wider than the first **narrower** frequency band.

Claim 93. The method of claim 87, the at least one repeated header bit increases ~~the~~ reliability of the **first** packet in the first~~,~~ narrower frequency band.

Claim 94. The method of claim 87, wherein the at least one repeated header bit provides additional diversity to increase ~~the~~ **a** likelihood of correctly decoding header information of the first packet in the first~~,~~ narrower frequency band.

Claim 95. A method in a wireless OFDM **(Orthogonal Frequency Division Multiplexing)** transceiver comprising:

receiving, by a wireless OFDM communications receiver, a first packet in a first **narrower** frequency band**,** wherein the first packet comprises a first header portion received on a first number of OFDM symbols;

demodulating, by a demodulator connected to the **wireless OFDM communications** receiver, the first number of OFDM symbols to determine the first header portion, wherein at least one header bit of the **first** header portion **in the first packet** is repeated on a plurality of OFDM subcarriers;

receiving, a second packet in a second **wider** frequency band, by the wireless OFDM communications receiver, ~~wherein the second frequency band is wider than the first frequency band, and~~ wherein the second packet comprises a second header portion received on a second number of OFDM symbols, less than the first number of OFDM symbols**, and wherein the second header portion different than the first header portion**;

demodulate, by the demodulator, the second number of OFDM symbols to determine the second header portion,

wherein the first **narrower** and second **wider** frequency bands have one or more overlapping frequency regions.

Claim 96. The method of claim 95, wherein the at least one repeated header bit increases ~~the~~ reliability of the **first** packet in the first~~,~~ narrower frequency band.

Claim 97. The method of claim 95, wherein the at least one repeated header bit provides additional diversity to increase ~~the~~ **a** likelihood of correctly decoding header information of the first packet in the first~~,~~ narrower frequency band.

Claim 98. The method of claim 95, wherein the second **wider** frequency band is one of: two times wider, four times wider and eight times wider than the first **narrower** frequency band.

Claim 100. The wireless method of claim 95, wherein a first OFDM symbol in the first packet contains the ~~same~~ **first plurality of** header bits ~~as~~ **and** a second OFDM symbol in the first packet **contains the first plurality of header bits**.

Claim 102. The method of claim 95, wherein the wireless transceiver supports one or more wireless ~~protocols~~ **standards**.

Reason for Allowance

4. Prior art of record fails to disclose demodulating the first number OFDM symbols to determine the first header bits of the first packet that is received at a first narrower frequency band and demodulating the second number of OFDM symbols that is less than the first number of OFDM symbols to determine the second header bits of the second packet that is received at a second wider frequency band.

Therefore, regarding claims 19, 66-80 and 87-102 (renumbered as 1-32 respectively) having considered all limitations do not appear to be anticipated by, or obvious in view of, the prior art of record.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

I. Vrzic (US 2010/0260137 A1) discloses channelization systems.

II. Kwon (US 2010/0208594 A1) discloses frame control header.

III. Pu (US 2010/0158046 A1) discloses generating packets in an OFDM system.

IV. Weir (US 2010/0085964 A1) discloses communications system.

V. Kuchibhotla (US 2009/0086646 A1) discloses status report in a system.

VI. Zheng (US 2008/0219229 A1) discloses a relay communication system.

VII. Williams (US 2005/0169261 A1) discloses length of OFDM WLAN packets.

6. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to SHAWKAT M. ALI whose telephone number is (571) 270-1639. The Examiner can normally be reached on Monday-Thursday between 9:00AM and 4:30PM.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's Supervisor, SAM K. AHN can be reached on (571) 272-3044. 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.

/SHAWKAT M ALI/

Examiner, Art Unit 2633

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	13/376,856	KIM ET AL.	
	Examiner	Art Unit	
	SHAWKAT M. ALI	2633	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SHAWKAT M. ALI*. (3)_____.

(2) *Jason H. Vick*. (4)_____.

Date of Interview: *12 September 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☒112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *All*.

Identification of prior art discussed: *None*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Claims 19, 66-80, 87-89, 91-98, 100 and 102 have been amended as set forth in the Examiner's Amendment.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SHAWKAT M ALI/ Examiner, Art Unit 2633	

Notice of References Cited	Application/Control No. 13/376,856	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner SHAWKAT M. ALI	Art Unit 2633	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2010/0260137 A1	10-2010	Vrzic; Sophie	H04L5/0007	370/330
*	B	US-2010/0208594 A1	08-2010	Kwon; Yeong Hyeon	H04L1/0041	370/242
*	C	US-2010/0158046 A1	06-2010	Pu; Tianyan	H04L27/2626	370/474
*	D	US-2010/0085964 A1	04-2010	Weir; Alexander	H04L1/0084	370/389
*	E	US-2009/0086646 A1	04-2009	KUCHIBHOTLA; RAVI	H04L1/1621	370/252
*	F	US-2008/0219229 A1	09-2008	ZHENG; Ruobin	H04B7/15557	370/338
*	G	US-2005/0169261 A1	08-2005	Williams, Richard G. C.	H04L27/2602	370/389
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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BIB DATA SHEET

CONFIRMATION NO. 7171

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/376,856	02/08/2012	375	2633	8365-87-PUS

APPLICANTS

INVENTORS

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/US10/46088 08/20/2010
which claims benefit of 61/235,909 08/21/2009

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

03/23/2012

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No					
Verified and Acknowledged	/SHAWKAT M ALI/ Examiner's Signature	Initials	MA	8	32	4

ADDRESS

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202
UNITED STATES

TITLE

METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

FILING FEE RECEIVED	FEES: Authority has been given in Paper	☐ All Fees
2460	No._____ to charge/credit DEPOSIT ACCOUNT	☐ 1.16 Fees (Filing)
	No._____ for following:	☐ 1.17 Fees (Processing Ext. of time)
		☐ 1.18 Fees (Issue)
		☐ Other _____
		☐ Credit

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	)	Group Art Unit: 2633
Application No.: 13/376,856	)	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	)	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	)	

For: A METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

AMENDMENT AFTER FINAL

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

OK TO ENTER: /S.A./

Madam:

Applicants submit this Amendment After Final to address the Final Office Action having a mailing date of August 18, 2016. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Abstract begin on page 3 of this paper.

Amendments to the Claims are shown in the listing of claims which begins on page 5 of this paper.

Remarks begin on page 12 of this paper.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

CPC- SEARCHED		
Symbol	Date	Examiner
H04B1/38, H04B7/00, H04B7/155	9/11/2016	/SA/
H04J1/00, H04J3/00, H04J3/24, H04J11/00	9/11/2016	/SA/
H04L1/00, H04L1/08, H04L5/00, H04L12/26, H04L12/43, H04L12/54, H04L12/56, H04L12/403, H04L27/28	9/11/2016	/SA/
H04M1/00	9/11/2016	/SA/
H04W4/00, H04W24/00, H04W52/02, H04W72/04, H04W72/12, H04W74/08	9/11/2016	/SA/

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	207,229,242,252,294,328,329,330,336,338,356,389,449,474	9/11/2016	/SA/
375	219,260,267,295,316	9/11/2016	/SA/

SEARCH NOTES		
Search Notes	Date	Examiner
Inventors, Assignee, Class/Subclass, CPC, Keywords, IEEE and Google Search	9/11/2016	/SA/

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
370	207,229,242,252,294,328,329,330,336,338,356,389,449,474	9/11/2016	/SA/

/SHAWKAT M ALI/ Examiner Art Unit 2633	

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
375	130,219,259,260,261,267,295,316	9/11/2016	/SA/

/SHAWKAT M ALI/ Examiner Art Unit 2633	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	**Art Unit**
	SHAWKAT M ALI	2633

CPC						
Symbol					**Type**	**Version**
H04L		1	/	08	F	2013-01-01
H04L		27	/	2613	A	2013-01-01
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CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
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			/					

		Total Claims Allowed:	
(Assistant Examiner)	(Date)	32	
/SHAWKAT M ALI/ Examiner Art Unit 2633	09/12/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	19	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M ALI	2633

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
375	219	H	0	4	B	1 / 38 (2006.01.01)						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											

(Assistant Examiner)	(Date)	Total Claims Allowed: 32	
/SHAWKAT M ALI/ Examiner Art Unit 2633	09/12/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	19	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13376856	KIM ET AL.
	Examiner	**Art Unit**
	SHAWKAT M ALI	2633

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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-	2	-	18	-	34	-	50	2	66	-	82	28	98		
-	3	1	19	-	35	-	51	3	67	-	83	29	99		
-	4	-	20	-	36	-	52	4	68	-	84	30	100		
-	5	-	21	-	37	-	53	5	69	-	85	31	101		
-	6	-	22	-	38	-	54	6	70	--	86	32	102		
-	7	-	23	-	39	-	55	7	71	17	87				
-	8	-	24	-	40	-	56	8	72	18	88				
-	9	-	25	-	41	-	57	9	73	19	89				
-	10	-	26	-	42	-	58	10	74	20	90				
-	11	-	27	-	43	-	59	11	75	21	91				
-	12	-	28	-	44	-	60	12	76	22	92				
-	13	-	29	-	45	-	61	13	77	23	93				
-	14	-	30	-	46	-	62	14	78	24	94				
-	15	-	31	-	47	-	63	15	79	25	95				
-	16	-	32	-	48	-	64	16	80	26	96				

(Assistant Examiner)	(Date)	**Total Claims Allowed:** 32	
/SHAWKAT M ALI/ Examiner Art Unit 2633	09/12/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	19	1

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	(13/376856).APP.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/06/06 10:59
S2	2601	((Joon) near2 (Kim)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:11
S3	237	((Marcos) near2 (Tzannes)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/11 09:12
S4	2832	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:12
S5	3	S4 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:13
S6	28058	(370/338,356,458,468).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S7	16810	(375/219,260).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S8	44525	S6 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S9	158	S8 and "OFDM" and "TXOP" and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:51
S10	80	S8 and "OFDM" and ("TXOP" same ("MAC" "MAP"))	US-PGPUB; USPAT; USOCR;	OR	ON	2014/06/11 09:52

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S11	45	S10 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/06/11 09:52
S13	467	beacon near2 header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/10 11:46
S14	21	"OFDM" same "TXOP" same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 15:35
S15	325	"TXOP" with bit	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
S16	3069	"OFDM" same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/15 16:59
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or ("20100322295") or ("8767523") or ("20110182254") or ("8159969") or ("7577085") or ("9148806") or ("8416677") or ("8537703") or ("20130170411") or ("9100275") or ("20100303096") or ("7944851") or ("8165096") or ("9148801") or ("20150304217") or ("20140112225") or ("9191469") or ("20090285164") or ("20140301208") or ("20140050133") or ("20140161126") or ("20140140358") or ("20100050054") or ("20140233551") or ("8464138") or ("20120327987") or ("20130287045") or ("20140198780") or ("7577122") or ("20130272309") or ("20140211678") or ("20130138982") or ("20100265999") or ("20150319272") or ("20150016426") or ("20130235860") or ("9049155") or ("7849391") or ("9210611") or ("7415661") or ("20050195765") or ("20100061320") or ("7512185") or ("20150016360") or ("7062703") or ("8467331") or ("20150023288") or ("20060193277") or ("20080273536") or ("20140369263") or ("20120189042") or ("20090041134") or ("8023593") or ("9071990") or ("8897298") or ("20140071997") or ("8488442") or ("20130107895") or ("8576882") or ("20060023802") or ("7881237") or ("8797836") or ("8498350") or ("20070286066") or ("20090141668") or ("20140341066") or ("20120250796") or ("20140233478") or ("20130016651") or ("20140269559") or ("20130265920") or ("8576938") or ("20140269659") or ("20110280329") or ("8385308") or ("20100118772") or ("9100072") or ("8781016") or ("20140079145") or ("20060212773")).PN. or (("20140198805") or ("9112753") or ("20150146607") or ("20110280261") or ("20120257606") or ("20150131530") or ("20110286404") or ("20110286322") or ("20140307625") or ("9001909") or ("20140219264") or ("20050232139") or ("8964521") or ("20130107912") or ("20150055546") or ("20120027119") or ("20120250668") or ("20120250617") or ("20140254349") or ("20140128066") or ("9191882") or ("9191092") or ("8737189") or ("20060182017") or ("20150124794") or ("9001904") or ("20140029645") or ("20090238293") or ("20140112397") or ("8218661") or ("20100046441") or ("20110268161") or ("20150030101") or ("20080198786") or ("8730878") or ("20110280332") or ("8576753") or ("20150124704") or ("20130223422") or ("20120051361") or ("20110216816") or ("20140006908") or ("20140119351") or ("8693558") or ("8457125") or ("7995672") or ("20150110163") or ("20140071956") or ("8660013") or ("8315235") or ("7995665") or ("20100086013") or ("20100202424") or ("8479076") or ("20130114757") or ("20100189167") or ("20100157907") or ("9008066") or ("8255760") or ("20110038284") or ("20120314711") or ("8774222") or ("20020012343") or ("8958464") or ("20100115372") or ("9066297") or ("8437245") or ("9143290") or ("20010055311") or ("20140146722") or ("20120207140") or ("20110051706") or ("20050169261") or ("20140192985") or ("8948284") or ("7035285") or ("6898204") or ("20150201433") or

		("20090312073") or ("8498607") or ("20140146758") or ("20130279389") or ("20130128809") or ("20080031205") or ("20120314744") or ("20110267956") or ("7046746") or ("20110164707") or ("20110268200") or ("20090316815") or ("20060176968") or ("6882634") or ("8576931") or ("20140036775") or ("20020012337") or ("20050094569") or ("20140064262") or ("20130128808") or ("8223867") or ("20030206561") or ("20140348117") or ("20140328435") or ("7426249") or ("20080187136") or ("7433298") or ("20020057713") or ("20080170556") or ("6988236") or ("8804609") or ("20060215626") or ("8966346") or ("20100329195") or ("6950444") or ("9014205") or ("20120054584") or ("20020003792") or ("8761033") or ("20020080886") or ("20130142094") or ("8867565") or ("20070060149")).PN.				
S19	250	(("20120170625") or ("20050249266") or ("20040198265") or ("8537796") or ("7421046") or ("7580444") or ("20060140251") or ("20150327284") or ("7656850") or ("20110080963") or ("20110110437") or ("20070091785") or ("8761307") or ("8989233") or ("20140247815") or ("20150195839") or ("20140341139") or ("20130182663") or ("20140254504") or ("8681767") or ("20110176532") or ("20140286183") or ("20110013534") or ("7796716") or ("20080043888") or ("9154963") or ("8824396") or ("8498239") or ("8837440") or ("20070004465") or ("20130343267") or ("20120155408") or ("7804772") or ("20110310835") or ("20130322363") or ("7936806") or ("9166718") or ("8831121") or ("20120327875") or ("20030021237") or ("8774101") or ("20130114491") or ("20080187063") or ("20140348056") or ("20120201229") or ("9191036") or ("9130699") or ("20140019828") or ("8761229") or ("20150017989") or ("20110205999") or ("20130301549") or ("20110026642") or ("9178677") or ("8879602") or ("20060114826") or ("9118401") or ("20150094078") or ("20080130486") or ("20090310619") or ("8169994") or ("8553790") or ("8891350") or ("8102929") or ("20100272192") or ("8649443") or ("20080013640") or ("20130329661") or ("20080219235") or ("8532082") or ("20110019715") or ("8276025") or ("20100002675") or ("20120188946") or ("20130294399") or ("20100202493") or ("20140355555") or ("8848581") or ("20140016579") or ("20150036629") or ("20120087396") or ("8917697") or ("20090307541") or ("8363577") or ("8619805") or ("20120128035") or ("20100272219") or ("8050203") or ("20120163334") or ("20110274016") or ("20070091983") or ("20130195145") or ("6014545") or ("20020034267") or ("6246716") or ("20020054632") or ("7089014") or ("9066334") or ("8593979") or ("8660042") or ("20060153155") or ("8958374") or ("7983356") or ("20030027577") or ("20120287877") or ("8724742") or ("8817844") or ("20120320951") or ("20130163449") or ("20060008016") or ("8472555") or ("20150189676") or ("9078278") or ("8855073") or ("20110058626") or	US-PGPUB; USPAT	OR	OFF	2015/12/16 07:23

		("7668265") or ("20110319113") or ("20140211892") or ("7872583") or ("20110026419") or ("20130235943") or ("7460620") or ("20110110321") or ("5511090") or ("8411660") or ("20140198758") or ("20060280116") or ("9137803") or ("20120281625") or ("20150304995")).PN. or (("20120307760") or ("9112686") or ("20150289144") or ("20090004984") or ("9001935") or ("20150003379") or ("20030161411") or ("8213367") or ("20090041087") or ("8848763") or ("9088385") or ("20130315184") or ("20070263702") or ("7099413") or ("20070082633") or ("7940852") or ("20150009927") or ("8780798") or ("20020177446") or ("7706247") or ("7620112") or ("8472385") or ("7564863") or ("20130294333") or ("20070097915") or ("7483674") or ("8705655") or ("7876840") or ("7180850") or ("7280607") or ("20060029168") or ("6795485") or ("7653122") or ("20150358193") or ("7626918") or ("20130070692") or ("20110317633") or ("20140307689") or ("20090080575") or ("20140029568") or ("20140119244") or ("20090262700") or ("20150036651") or ("8284732") or ("7609712") or ("20150172949") or ("20150017923") or ("8867469") or ("20130182685") or ("20060008017") or ("20110310856") or ("20070105508") or ("6711122") or ("8660081") or ("20120269287") or ("8615046") or ("20110122846") or ("7184485") or ("9173109") or ("20140241326") or ("20060046659") or ("20070263735") or ("20110110320") or ("20150326347") or ("20110188585") or ("20070086326") or ("7853205") or ("20140126526") or ("20070081505") or ("20050237923") or ("8483086") or ("8718021") or ("9071399") or ("20070110149") or ("20070086327") or ("20050030885") or ("6477210") or ("9100152") or ("20020067755") or ("20070064587") or ("20060212773") or ("8238496") or ("8054897") or ("5278826") or ("6853675") or ("8320320") or ("20120307917") or ("20020159516") or ("8891475") or ("8547911") or ("8902869") or ("20130163530") or ("20070201350") or ("20100195614") or ("20110206147") or ("20110103338") or ("8437245") or ("8089946") or ("7039105") or ("20070121741") or ("20110051706") or ("20130016694") or ("8422465") or ("20090290552") or ("8045991") or ("7599346") or ("8693442") or ("20110211652") or ("7969311") or ("20110182332") or ("7376117") or ("20110103500") or ("8891593") or ("20130163501") or ("8089887") or ("20140269368") or ("20050190715") or ("20130028209") or ("20140119291") or ("20040081191")).PN.				
S20	6	S18 and S19	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 07:24
S21	9	S18 and "TXOP"	US-PGPUB; USPAT; USOCR;	OR	ON	2015/12/16 07:28

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S22	2	("20040179517").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/16 08:46
S23	2	("20070171858").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/16 09:53
S24	16965	((media adj access adj plan) "MAP") near3 frame	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:03
S25	7581	((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S26	252	S24 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S27	170	S24 and S25 and header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:04
S28	96	S24 and S25 and header and (ofdm$1 dmt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/16 10:05
S29	2	("20040179517").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/22 07:40
S31	84	((orthogonal adj frequency adj division adj multiplex$3) or "OFDM") with ((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/26 11:24

S32	41	("20070060149" | "20070177541" | "20070206534" | "20080075058" | "20080084941" | "20080192644" | "20080292015" | "20090196163" | "20100046358" | "20100067589" | "20100091675" | "20100118829" | "20100309834" | "20110002219" | "20110038332" | "20110096796" | "20110096797" | "20110128929" | "20110128947" | "20110310827" | "20120082040" | "20130286959" | "7599332" | "7742390" | "8144647" | "8149811" | "8270909" | "8363578" | "8395997" | "8472383" | "8599803" | "8619907" | "8660497" | "8670399" | "8737405" | "8787338" | "8787385" | "8811203" | "8886755" | "8923118" | "8971350").PN. OR ("9215055").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/26 11:33
S33	16	S32 and ((transmission adj opportunity) or "TXOP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/26 11:33
S34	31	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same ((transmission adj opportunity) or txop) same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:03
S35	10	("20050226204" | "20050254465" | "20060018268" | "20070058575" | "20080036909" | "20080181155" | "20090040965" | "7324605").PN. OR ("8817698").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 11:22
S36	73	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same ((transmission adj opportunity) or txop) same (header packet peamble)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:39
S37	42	S36 not S34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:39
S38	8	S37 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 11:40
S39	19	("20030016686" | "20050055406" | "20050147034" | "20050175014" | "20060168313" | "6426943" | "6473425" | "6606301" | "6832261" | "6959002" | "7310337" | "7457313" | "7580355").PN. OR ("8139593").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 11:51
S40	64423	(370/229,294,328,329,336,338,356,449).ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:26
S41	28065	(375/219,260,267,295,316).ccls.	US-PGPUB;	OR	ON	2015/12/27

			USPAT; USOCR			12:26
S42	2815	(H04B1/38 H04B7/155).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:27
S43	1559	(H04J1/00 H04J3/00 H04J3/24 H04J11/00).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:28
S44	8852	(H04L1/00 H04L1/08 H04L5/00 H04L12/26 H04L12/43 H04L12/56 H04L12/403 H04L27/28).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:30
S45	440	(H04M1/00).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:31
S47	22074	(H04W4/00 H04W24/00 H04W52/02 H04W72/04 H04W72/12 H04W74/08).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:33
S48	117614	S40 S41 S42 S43 S44 S45 S47	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:33
S49	37065	S48 and ofdm$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:33
S50	503	S49 and (((transmission adj opportunity) or txop) same (header packet peamble))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:34
S51	244	S49 and (((transmission adj opportunity) or txop) same (header peamble))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:34
S52	37	S51 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 12:35
S53	10	("20060239223" | "20070232358" | "20080089261" | "20080130603" | "6917598" | "7002929" | "7046649").PN. OR ("8155695").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 12:57
S54	761	S48 and ofdm$1 and ((transmission adj opportunity) or txop) and header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:18
S55	186	S54 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:18

S56	149	S55 not (S34 S38 S52)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:19
S57	141	S56 and ("MAC" "MAP")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:20
S58	130	S56 and ("MAC" "MAP") and frame	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/27 13:20
S59	16	("20020141375" | "20040166870" | "20050075104" | "20070099567" | "20070224936" | "20080177751" | "20080254810" | "20090054002" | "20090147867" | "20090176454" | "20090196173" | "20090257379" | "20100085903" | "5237587" | "5774876" | "6249680").PN. OR ("8995996").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/12/27 13:58
S60	1	(13/376856).APP.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/08/07 12:51
S61	405	ofdm with packet with header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/07 15:59
S62	55	S61 and overlapp$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/07 16:00
S63	4643	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 10:00
S64	33411	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) same de$1modulat$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 10:02
S65	75803	frequency with overlap$4	US-PGPUB; USPAT; USOCR;	OR	ON	2016/09/05 10:03

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S66	233	S63 and S64 and S65	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 10:03
S67	182	S66 and packet	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 10:04
S68	2	S66 and packet and (header adj bit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 10:04
S69	27	("20010048694" | "20050152358" | "20060222005" | "20080080437" | "20090316637" | "20100014463" | "20100016023" | "20100067379" | "20100177755" | "20100183087" | "20100260114" | "20110019557" | "20110026623" | "20110128846" | "20110128900" | "20110134816" | "20110149822" | "20110188424" | "20110267959" | "20110310834" | "20120014335" | "20140036895" | "8081665" | "8503367" | "8509193" | "8599803").PN. OR ("8982914").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/05 10:09
S70	78	S66 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 11:16
S71	7639	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) with (header pilot preamble training) with (packet frame slot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 13:02
S72	660	(frequency with overlap$4) and S71	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 13:03
S73	23442	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 dmt (multi adj2 carrier)) with de$1modulat$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 13:03
S74	230	S72 and S73	US-PGPUB;	OR	ON	2016/09/05

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:04
S75	130	S74 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/05 13:04
S76	25	("20020034213" | "20030081695" | "20050135308" | "5732113" | "6954481" | "7020226").PN. OR ("7457231").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/05 13:59
S78	8	((first near2 header) same bit same (repeat$4 or repet$6)) and (ofdm$ dmt) and sub$1carrier and demodulat$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/08 13:25
S79	13	("20040066844" | "20060171283" | "20060215790" | "20060274855" | "20070195907" | "20070268977" | "20080279168" | "5966412" | "7260159" | "7274653").PN. OR ("8675754").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/08 13:49
S80	5	((first adj3 header) same bit same (second adj3 header) same symbol) and ofdm$1 and subcarrier and demodulat$4	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/08 13:58
S81	390	(second different another other next separate 2nd) near4 (header preamble) with (packet! segment! pdu!) and (segment$9 portions! sections!) with (channels! bands! ccs! (component near carriers!)) and @ad<="20090821"	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/08 14:01
S82	53	S81 and ofdm$1	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/08 14:02
S83	32	("20020053058" | "20030098804" | "20030126551" | "20040141525" | "20040148546" | "20040223473" | "20050276266" | "20060084389" | "20070016838" | "20070092013" | "20080090583" | "20080219373" | "20080279322" | "20100077275" | "4449190" | "6222889" | "6829313" | "6912249" | "7180901" | "7200799" | "7213194" | "7360141" | "7782973" | "7965710").PN. OR ("8345533").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/08 15:15
S84	38	header same (repeat$4 repet$6 duplicat$4) same ofdm$ same sub$1carrier	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/09 08:15
S85	5	("20110149929" | "20120243630" | "20130051489" | "20130064313" | "20140198877").PN. OR ("8942303").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/09 08:31
S86	3238	(wid$3 near3 band) and (narrow$3 near3 band) and ofdm$1	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/09 08:39
S87	54434	(second different another other next separate 2nd) near3 header	US-PGPUB; USPAT;	OR	ON	2016/09/09 08:40

			USOCR			
S88	46	S86 and S87	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/09 08:40
S89	265	("20010008837" | "20010055952" | "20020006799" | "20020008658" | "20020019214" | "20020077787" | "20020085503" | "20020086641" | "20020111772" | "20020142744" | "20020154614" | "20020155811" | "20020173272" | "20020177446" | "20030050012" | "20030050015" | "20030123420" | "20030198200" | "20030198304" | "20030224741" | "20050180528" | "3812291" | "4597107" | "4839582" | "5093927" | "5142691" | "5144642" | "5276908" | "5303262" | "5355522" | "5428819" | "5446370" | "5574979" | "5608727" | "5610839" | "5636140" | "5636903" | "5655217" | "5687163" | "5732077" | "5745777" | "5752164" | "5809427" | "5850596" | "5864541" | "5889772" | "5892812" | "5907812" | "5990833" | "6031833" | "6052421" | "6084919" | "6141565" | "6167237" | "6169728" | "6212566" | "6226680" | "6229799" | "6229998" | "6240282" | "6240372" | "6256478" | "6256511" | "6275695" | "6295461" | "6307839" | "6317599" | "6332076" | "6336780" | "6349198" | "6351643" | "6374079" | "6374082" | "6385434" | "6418131" | "6442371" | "6442507" | "6466614" | "6499006" | "6629151" | "6671495" | "6711134" | "6882851" | "7113753").PN. OR ("7424268").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/09 10:19
S90	8	header and ofdm$ and S89	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/09 10:20
S91	2	("8675754").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/09/10 16:37
S92	3	("20100085964").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/09/10 16:38
S93	3	("20090086646").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/09/10 16:38
S94	220338	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 10:43

S95	86835	(second different another other next separate 2nd multiple plural$4) near3 header	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 10:44
S96	2173	header with (sub$carrier tone sub$channel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 10:44
S97	8215	header with symbol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 10:44
S98	138	S94 and S95 and S96 and S97	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 10:45
S99	67	S98 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 10:46
S100	89	("4281412" | "4324001" | "4447871" | "4462108" | "4516239" | "4554656" | "4661902" | "4706246" | "4774704" | "5023869" | "5111453" | "5396519" | "5465267" | "5559561" | "5689510" | "5832233" | "6009122").PN. OR ("6130894").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 11:31
S101	16	S97 and S100	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 11:31
S102	23783	(frame packet segment slot pdu) with (narrow$3 wid$3) with (band frequency)	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 11:48
S103	3003	S94 and S102	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 11:48
S104	114	S94 and S102 and S97	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 11:48
S105	111	S104 not (S99 S101)	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 11:48
S106	65	S105 and @ad<="20090821"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/11 11:48
S107	9	("20050088318" | "20060009228" | "20060153132" | "20070291713" | "20080090575" | "5839071" | "5875183" |	US-PGPUB; USPAT; USOCR	OR	ON	2016/09/11 12:13

		"6246955" | "6791475").PN. OR ("8665816").URPN.				

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S77	1	"Term Removed"	US-PGPUB; USPAT	OR	OFF	2016/09/08 12:07
S108	3400	((Joon) near2 (Kim)).INV.	US-PGPUB; USPAT	OR	ON	2016/09/11 12:37
S109	299	((Marcos) near2 (Tzannes)).INV.	US-PGPUB; USPAT	OR	ON	2016/09/11 12:37
S110	3688	S108 S109	US-PGPUB; USPAT	OR	ON	2016/09/11 12:37
S111	344	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)) and S110	US-PGPUB; USPAT	OR	ON	2016/09/11 12:37
S112	99	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)).clm. and S110	US-PGPUB; USPAT	OR	ON	2016/09/11 12:38
S113	28	(header with symbol) and S112	US-PGPUB; USPAT	OR	ON	2016/09/11 12:38
S114	80	("20010009555" | "20010022825" | "20010046877" | "20020006167" | "20020013135" | "20020031089" | "20020046379" | "20020057698" | "20020060995" | "20020068588" | "20020076043" | "20020114402" | "20020126694" | "20020136183" | "20020159533" | "20020184389" | "20030012163" | "20030018794" | "20030040280" | "20030048462" | "20030053571" | "20030063685" | "20030087659" | "20030095508" | "20030099312" | "20030112743" | "20030112821" | "20030135631" | "20030142766" | "20040151109" | "20040215709" | "20070037600" | "20130003587" | "20130286943" | "5706428" | "5797094" | "5812523" | "6075769" | "6084917" | "6108306" | "6115354" | "6141327" | "6151508" | "6181714" | "6341131" | "6418322" | "6449246" | "6535550" | "6549592" | "6587526" | "6625764" | "6671284" | "6894974" | "6904283" | "6940831" | "6987754" | "6988212" | "7088787" | "7092436" | "7106715" | "7146172" | "7158482" | "7272117" | "7274652" | "7304951" | "7362735" | "7522514" | "7590071" | "7729281" | "7804765" | "7916625" | "7924841" | "7944851" | "8159969" | "8284800" | "8416677" | "8537703" | "8553579" | "8755264" | "8842570").PN. OR ("9148806").URPN.	US-PGPUB; USPAT	OR	ON	2016/09/11 12:45
S115	22	(header with symbol) and S114	US-PGPUB; USPAT	OR	ON	2016/09/11 12:46
S116	16	(header with symbol).clm. and S112	US-PGPUB; USPAT	OR	ON	2016/09/11 12:55
S117	7	(header with (sub$carrier tone sub$channel)).clm. and S116	US-PGPUB; USPAT	OR	ON	2016/09/11 12:56
S118	4	((frame packet segment slot pdu) with (narrow$3 wid$3) with (band frequency)).clm. and S112	US-PGPUB; USPAT	OR	ON	2016/09/11 12:59
S119	4	((frame packet segment slot pdu) with (narrow$3 wid$3) with (band frequency)).clm. and S117	US-PGPUB; USPAT	OR	ON	2016/09/11 13:00
S120	0	(repeat$4 repet$6 duplicat$4 cop$4).clm. and S119	US-PGPUB; USPAT	OR	ON	2016/09/11 13:01
S121	352	(AWARE adj INC).as.	US-	OR	ON	2016/09/11

			PGPUB; USPAT			13:01
S122	70	((narrow$3 wid$3) with (band frequency)) and S121	US-PGPUB; USPAT	OR	ON	2016/09/11 13:02
S123	19	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)).clm. and S122	US-PGPUB; USPAT	OR	ON	2016/09/11 13:02
S124	2	(header with symbol) and S123	US-PGPUB; USPAT	OR	ON	2016/09/11 13:03
S125	12	("20030215021" | "20080056390" | "6115354" | "20080137718" | "20100208854" | "20090041151" | "20070218843" | "20050265433" | "20100158091" | "20140105328" | "20050243791" | "8498350").PN.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:05
S126	101669	(370/207,229,242,252,294,328,329,330,336,338,356,389,449,474).ccls.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S127	33757	(375/130,219,259,260,261,267,295,316).ccls.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S128	3268	(H04B1/38 H04B7/00 H04B7/155).cpc.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S129	1685	(H04J1/00 H04J3/00 H04J3/24 H04J11/00).cpc.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S130	9724	(H04L1/00 H04L1/08 H04L5/00 H04L12/26 H04L12/43 H04L12/54 H04L12/56 H04L12/403 H04L27/28).cpc.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S131	432	(H04M1/00).cpc.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S132	24253	(H04W4/00 H04W24/00 H04W52/02 H04W72/04 H04W72/12 H04W74/08).cpc.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:12
S133	160246	S126 S127 S128 S129 S130 S131 S132	US-PGPUB; USPAT	OR	ON	2016/09/11 13:13
S134	12830	((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)).clm. and S133	US-PGPUB; USPAT	OR	ON	2016/09/11 13:13
S135	566	(header with symbol) and S134	US-PGPUB; USPAT	OR	ON	2016/09/11 13:14
S136	192	((repeat$4 repet$6 duplicat$4 cop$4) with header) and S135	US-PGPUB; USPAT	OR	ON	2016/09/11 13:14
S137	33	(header with (sub$carrier tone sub$channel)) and S136	US-PGPUB; USPAT	OR	ON	2016/09/11 13:15
S138	25	S137 not S113	US-PGPUB; USPAT	OR	ON	2016/09/11 13:15
S139	95	("5241545" | "5420851" | "5504775" | "5606560" | "5920547").PN. OR ("6567383").URPN.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:20
S140	3	(header with symbol) and S139	US-PGPUB; USPAT	OR	ON	2016/09/11 13:21
S141	49	("20030081538" | "20040085946" | "6515960" | "6567383" | "6643281" | "6741578" | "7039001").PN. OR ("7738437").URPN.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:32
S142	2	(header with symbol) and S141	US-	OR	ON	2016/09/11

			PGPUB; USPAT			13:33
S143	4687	(((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)) with (frame packet segment slot pdu)).clm.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:35
S144	118	(header with symbol).clm. and S143	US-PGPUB; USPAT	OR	ON	2016/09/11 13:35
S145	17	((repeat$4 repet$6 duplicat$4 cop$4) with header) and S144 and (header with (sub$carrier tone sub$channel))	US-PGPUB; USPAT	OR	ON	2016/09/11 13:37
S147	0	(((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)) with (frame packet segment slot pdu) with header with symbol with (repeat$4 repet$6 duplicat$4 cop$4) with (sub$carrier tone sub$channel) with (narrow$3 wid$3) with (band frequency)).clm.	US-PGPUB; USPAT	OR	ON	2016/09/11 13:48
S148	0	(((orthogonal adj frequency adj division adj multiplex$3) or ofdm$1 or (discrete adj multi adj tone) or dmt or (multi adj2 carrier)) same (frame packet segment slot pdu) same header same symbol same (repeat$4 repet$6 duplicat$4 cop$4) same (sub$carrier tone sub$channel) same (narrow$3 wid$3) same (band frequency))	US-PGPUB; USPAT	OR	ON	2016/09/11 13:49

9/ 11/ 2016 3:29:37 PM
C:\ Users\ sali\ Documents\ EAST\ Workspaces\ Case_116_JK_13376856.wsp

AFCP 2.0 Decision	Application No.	Applicant(s)
	13/376,856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M. ALI	2633

This is in response to the After Final Consideration Pilot request filed 23 August 2016.

1. **Improper Request** – The AFCP 2.0 request is improper for the following reason(s) and the after final amendment submitted with the request will be treated under pre-pilot procedure.

   ☐ An AFCP 2.0 request form PTO/SB/434 (or equivalent document) was not submitted.

   ☐ A non-broadening amendment to at least one independent claim was not submitted.

   ☐ A proper AFCP 2.0 request was submitted in response to the most recent final rejection.

   ☐ Other:

2. **Proper Request**

   A. After final amendment submitted with the request will not be treated under AFCP 2.0.
   The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.

   ☐ The after final amendment will be treated under pre-pilot procedure.

   B. Updated search and/or completed additional consideration.
   The examiner performed an updated search and/or completed additional consideration of the after final amendment within the time authorized for the pilot program. The result(s) of the updated search and/or completed additional consideration are:

   ☒ 1. All of the rejections in the most recent final Office action are overcome and a Notice of Allowance is issued herewith.

   ☐ 2. The after final amendment would not overcome all of the rejections in the most recent final Office action. See attached interview summary for further details.

   ☐ 3. The after final amendment was reviewed, and it raises a new issue(s). See attached interview summary for further details.

   ☐ 4. The after final amendment raises new issues, but would overcome all of the rejections in the most recent final Office action. A decision on determining allowability could not be made within the guidelines of the pilot. See attached interview summary for further details, including any newly discovered prior art.

   ☐ 5. Other:

   Examiner Note: Please attach an interview summary when necessary as described above.

PART B - FEE(S) TRANSMITTAL

Complete 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)

62574 7590 09/27/2016

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

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.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

TITLE OF INVENTION: METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	12/27/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALI, SHAWKAT M	2633	375-219000

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 Jason H. Vick
2 Sheridan Ross, PC
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: APPLIED TRANSFORM, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Bedford, MA

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. Form PTO-2038 is attached.
☑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 19-1970 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ Applicant certifying micro entity status. See 37 CFR 1.29
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.
☐ Applicant asserting small entity status. See 37 CFR 1.27
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.
☐ Applicant changing to regular undiscounted fee 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 /Jason H. Vick/ Date November 7, 2016

Typed or printed name Jason H. Vick Registration No. 45,285

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	)	Group Art Unit: 2633
Application No.: 13/376,856	)	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	)	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	)	

For: METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

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

Madam:

Applicant submits this Comments on Statement of Reasons for Allowance to address further the Notice of Allowability ("Notice") having a mailing date of September 27, 2016.

In the Notice, the Examiner's stated reasons for allowance were that:

> Prior art of record fails to disclose demodulating the first number OFDM symbols to determine the first header bits of the first packet that is received at a first narrower frequency band and demodulating the second number of OFDM symbols that is less than the first number of OFDM symbols to determine the second header bits of the second packet that is received at a second wider frequency band.
>
> Therefore, regarding claims 19, 66-80 and 87-102 (renumbered as 1-32 respectively) having considered all limitations do not appear to be anticipated by, or obvious in view of, the prior art of record.

While the stated Reasons for Allowance may be a stated reason for allowing some independent claims, Applicant submits that some independent claims have a different reason for allowance and that some independent claims have other reasons for allowance.

Specifically, the prior art fails to teach the specific combination of features as recited in the independent claims 19, 73, 87, and 95.

Although the Applicant believes that no fees are due for filing this Comments on Statement of Reasons for Allowance, please charge any fees deemed necessary to Deposit Account No. 19-1970.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: November 7, 2016

By: /Jason H. Vick/

Jason H. Vick,
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	)	Group Art Unit: 2633
Application No.: 13/376,856	)	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	)	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	)	

For: METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

APPLICANT'S RESPONSE TO INTERVIEW SUMMARY

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

Madam:

Applicant would like to thank Examiner Ali for the courtesies extended to Applicant's undersigned representative during the September 12, 2016 telephone interview. During the interview claims 19, 66-80, 87-89, 91-98, 100, and 102 were discussed. The amendments to the claims are accurately reflected in the September 27, 2016 Examiner's Amendment.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: November 7, 2016

By: /Jason H. Vick/
Jason H. Vick
Reg. No. 45,285
1560 Broadway, Suite 1200
Denver, Colorado 80202
Telephone: 303-863-9700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Joon Bae Kim	Group Art Unit: 2633
Application No.: 13/376,856	Examiner: ALI, SHAWKAT M
Filed: February 8, 2012	Confirmation No.: 7171
Atty. File No.: 8365-87-PUS	

For: METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS

AMENDMENT AFTER ALLOWANCE UNDER 37 C.F.R. 1.312

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

Madam:

Applicants submit this Amendment After Allowance pursuant to 37 C.F.R. 1.312 in response to the Notice of Allowance having a mailing date of September 27, 2016. While Applicants believe that no fees are due with the filing of this response, the undersigned hereby authorizes the charge of any fees deemed necessary to Deposit Account No. 19-1970.

An amendment may be entered after the mailing of a Notice of Allowance but prior to payment of the issue fee upon recommendation of the primary Examiner. Therefore, it is respectfully requested that the above-referenced application be amended as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 9 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-18. (Cancelled)

19. (Currently Amended) A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver operable to:

receive, in a first narrower frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulate, by a demodulator connected to and in communication with the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the first plurality of header bits in the first packet is repeated on a plurality of OFDM subcarriers;

receive, in a second wider frequency band, by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits, different than the first plurality of header bits; and

demodulate, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

wherein the first narrower and second wider frequency bands have one or more overlapping frequency regions.

20-65. (Cancelled)

66. (Previously Presented) The wireless transceiver of claim 19, wherein the at least one repeated header bit increases reliability of the first packet in the first, narrower frequency band.

67. (Previously Presented) The wireless transceiver of claim 19, wherein the at least one repeated header bit provides additional diversity to increase a likelihood of correctly decoding header information of the first packet in the first, narrower frequency band.

68. (Currently Amended) The wireless transceiver of claim 19, wherein the second wider frequency band is ~~one of:~~ two times wider~~, four times wider and eight times wider~~ than the first narrower frequency band.

69. (Previously Presented) The wireless transceiver of claim 19, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

70. (Previously Presented) The wireless transceiver of claim 19, wherein a first OFDM symbol in the first packet contains the first plurality of header bits and a second OFDM symbol in the first packet contains the first plurality of header bits.

71. (Previously Presented) The wireless transceiver of claim 19, wherein the wireless transceiver supports SmartGrid applications.

72. (Previously Presented) The wireless transceiver of claim 19, wherein the wireless transceiver supports one or more wireless standards.

73. (Currently Amended) A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver comprising:

a wireless OFDM communications receiver operable to receive a first packet in a first narrower frequency band, wherein the first packet comprises a first header portion received on a first number of OFDM symbols;

a demodulator, connected to the wireless OFDM communications receiver, ~~that demodulates~~operable to demodulate the first number of OFDM symbols to determine the first header portion, wherein at least one header bit of the first header portion in the first packet is repeated on a plurality of OFDM subcarriers;

the wireless OFDM communications receiver further operable to receive a second packet in a second wider frequency band, wherein the second packet comprises a second header portion received on a second number of OFDM symbols, less than the first number of OFDM symbols, and wherein the second header portion is different than the first header portion;

the demodulator further operable to demodulate the second number of OFDM symbols to determine the second header portion,

wherein the first narrower and second wider frequency bands have one or more overlapping frequency regions.

74. (Previously Presented) The wireless transceiver of claim 73, wherein the at least one repeated header bit increases reliability of the first packet in the first, narrower frequency band.

75. (Previously Presented) The wireless transceiver of claim 73, wherein the at least one repeated header bit provides additional diversity to increase a likelihood of correctly decoding header information of the first packet in the first, narrower frequency band.

76. (Currently Amended) The wireless transceiver of claim 73, wherein the second wider frequency band is ~~one of~~ two times wider~~, four times wider and eight times wider~~ than the first narrower frequency band.

77. (Previously Presented) The wireless transceiver of claim 73, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

78. (Previously Presented) The wireless transceiver of claim 73, wherein a first OFDM symbol in the first packet contains the first plurality of header bits and a second OFDM symbol in the first packet contains the first plurality of header bits.

79. (Previously Presented) The wireless transceiver of claim 73, wherein the wireless transceiver supports SmartGrid applications.

80. (Previously Presented) The wireless transceiver of claim 73, wherein the wireless transceiver supports one or more wireless standards.

81-86. (Cancelled)

87. (Previously Presented) A method of operating a wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver comprising:

receiving, in a first narrower frequency band, by a receiver using wireless OFDM communications, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits;

demodulating, by a demodulator connected to the receiver, the first number of OFDM symbols to determine the first plurality of header bits, wherein at least one header bit of the first plurality of header bits in the first packet is repeated on a plurality of OFDM subcarriers;

receiving, in a second wider frequency band, by the receiver using wireless OFDM communications, a second packet comprising a second number of OFDM symbols, less than the first number of OFDM symbols, that carry a second plurality of header bits different than the first plurality of header bits; and

demodulating, by the demodulator, the second number of OFDM symbols to determine the second plurality of header bits,

wherein the first narrower and second wider frequency bands have one or more overlapping frequency regions.

88. (Previously Presented) The method of claim 87, wherein a first OFDM symbol of the first packet contains different header bits than a second OFDM symbol of the first packet.

89. (Previously Presented) The method of claim 87, wherein a first OFDM symbol of the first packet contains the first plurality of header bits and a second OFDM symbol of the first packet contains the first plurality of header bits.

90. (Previously Presented) The method of claim 87, wherein the wireless transceiver supports SmartGrid applications.

91. (Previously Presented) The method of claim 87, wherein the wireless transceiver supports one or more wireless standards.

92. (Currently Amended) The method of claim 87, wherein the second wider frequency band ~~is one of:~~ two times wider~~, four times wider and eight times wider~~ than the first narrower frequency band.

93. (Previously Presented) The method of claim 87, the at least one repeated header bit increases reliability of the first packet in the first narrower frequency band.

94. (Previously Presented) The method of claim 87, wherein the at least one repeated header bit provides additional diversity to increase a likelihood of correctly decoding header information of the first packet in the first, narrower frequency band.

95. (Currently Amended) A method in a wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver comprising:

receiving, by a wireless OFDM communications receiver, a first packet in a first narrower frequency band, wherein the first packet comprises a first header portion received on a first number of OFDM symbols;

demodulating, by a demodulator connected to the wireless OFDM communications receiver, the first number of OFDM symbols to determine the first header portion, wherein at least one header bit of the first header portion in the first packet is repeated on a plurality of OFDM subcarriers;

receiving, a second packet in a second wider frequency band, by the wireless OFDM communications receiver, wherein the second packet comprises a second header portion received on a second number of OFDM symbols, less than the first number of OFDM symbols, and wherein the second header portion is different than the first header portion;

demodulate, by the demodulator, the second number of OFDM symbols to determine the second header portion,

wherein the first narrower and second wider frequency bands have one or more overlapping frequency regions.

96. (Previously Presented) The method of claim 95, wherein the at least one repeated header bit increases reliability of the first packet in the first narrower frequency band.

97. (Previously Presented) The method of claim 95, wherein the at least one repeated header bit provides additional diversity to increase a likelihood of correctly decoding header information of the first packet in the first narrower frequency band.

98. (Currently Amended) The method of claim 95, wherein the second wider frequency band is ~~one of~~ two times wider~~, four times wider and eight times wider~~ than the first narrower frequency band.

99. (Previously Presented) The method of claim 95, wherein a first OFDM symbol in the first packet contains different header bits than a second OFDM symbol in the first packet.

100. (Previously Presented) The wireless method of claim 95, wherein a first OFDM symbol in the first packet contains the first plurality of header bits and a second OFDM symbol in the first packet contains the first plurality of header bits.

101. (Previously Presented) The method of claim 95, wherein the wireless transceiver supports SmartGrid applications.

102. (Previously Presented) The method of claim 95, wherein the wireless transceiver supports one or more wireless standards.

REMARKS

Claims 19, 68, 73, 76, 92, 95, and 98 have been amended to correct minor grammatical errors. No new matter is believed to be introduced by this amendment.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: November 7, 2016

By: /Jason H. Vick/

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Electronic Patent Application Fee Transmittal

Application Number:	13376856
Filing Date:	08-Feb-2012
Title of Invention:	METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS
First Named Inventor/Applicant Name:	Joon Bae Kim
Filer:	Jason Vick/Joanne Vos
Attorney Docket Number:	8365-87-PUS

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

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	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**960**

Electronic Acknowledgement Receipt

EFS ID:	27435978
Application Number:	13376856
International Application Number:	
Confirmation Number:	7171
Title of Invention:	METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS
First Named Inventor/Applicant Name:	Joon Bae Kim
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	8365-87-PUS
Receipt Date:	07-NOV-2016
Filing Date:	08-FEB-2012
Time Stamp:	17:34:23
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$960
RAM confirmation Number	110816INTEFSW00002717191970
Deposit Account	191970
Authorized User	Joanne Vos

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.492 (National application filing, search, and examination fees)

37 CFR 1.492(a) (Basic national fee only)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	ISSUE_FEE_PAYMENT.pdf	197972 f1a7c3351e0873c9124a9ca92a502e318a2f969d	no	1
Warnings:					
Information:					
2	Post Allowance Communication - Incoming	Comments_on_Reason_for_Allowance.pdf	73032 16fb78163d2a721eaca285d8af5a16cab2630784	no	2
Warnings:					
Information:					
3	Applicant summary of interview with examiner	Response_to_Interview_Summary.pdf	71419 b9f62db28bb35c6b176bfc1121f0b7a6ca1d5b7d	no	1
Warnings:					
Information:					
4		AMEND_312.pdf	97598 92bf8e4195b393e552ce2f3c32f28ce9174607bd	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	9

Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30954 f88d5830b55508cd3853335a80c1d0c8e70386bf	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	470975

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.

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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/08/2012	Joon Bae Kim	8365-87-PUS	7171

62574 7590 11/15/2016

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EXAMINER	
ALI, SHAWKAT M	

ART UNIT	PAPER NUMBER
2633	

NOTIFICATION DATE	DELIVERY MODE
11/15/2016	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):

jvick@sheridanross.com

Response to Rule 312 Communication	Application No.	Applicant(s)
	13/376,856	KIM ET AL.
	Examiner	Art Unit
	SHAWKAT M. ALI	2633

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

1. ☒ The amendment filed on *07 November 2016* under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.

Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/SHAWKAT M ALI/
Examiner, Art Unit 2633

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/376,856	02/28/2017	9584262	8365-87-PUS	7171

62574 7590 02/08/2017

Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

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 552 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):

Joon Bae Kim, Lexington, MA;
Marcos C. Tzannes, Orinda, CA;

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.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6890261

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
APPLIED TRANSFORM, LLC	08/26/2021

RECEIVING PARTY DATA

Name:	AX WIRELESS LLC
Street Address:	3000 POLAR LANE
City:	CEDAR PARK
State/Country:	TEXAS
Postal Code:	78613

PROPERTY NUMBERS Total: 9

Property Type	Number
Application Number:	61235909
Patent Number:	9584262
Patent Number:	9614566
Patent Number:	9973361
Patent Number:	10079707
Patent Number:	10291449
Patent Number:	10554459
Patent Number:	10917272
Application Number:	17136801

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Email: keith@axwireless.net
Correspondent Name: AX WIRELESS LLC
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Address Line 4: CEDAR PARK, TEXAS 78613

NAME OF SUBMITTER:	KEITH IM
SIGNATURE:	/keith k. lm/
DATE SIGNED:	08/30/2021

	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 5
source=Patent Assignment for AX Wireless (8-26-2021)#page1.tif
source=Patent Assignment for AX Wireless (8-26-2021)#page2.tif
source=Patent Assignment for AX Wireless (8-26-2021)#page3.tif
source=Patent Assignment for AX Wireless (8-26-2021)#page4.tif
source=Patent Assignment for AX Wireless (8-26-2021)#page5.tif

EXHIBIT B

PATENT ASSIGNMENT

This Patent Assignment (this "***Assignment***"), is made and entered into as of August 26, 2021 (the "***Effective Date***"), by Applied Transform, LLC, a Delaware Limited Liability Company ("***Assignor***"), with respect to the assignment of certain patent assets to AX Wireless, LLC, a Texas Limited Liability Company ("***Assignee***").

WHEREAS, Assignee and Assignor have entered into that certain Patent Transfer Agreement, dated August 2021 (the "***Patent Transfer Agreement***"), pursuant to which Assignor has agreed to assign and transfer to Assignee, and Assignee has agreed to receive all of Assignor's right, title and interest in and to (a) those patents and patent applications listed on Appendix I attached hereto (collectively, the ***"Listed Patents"***), including any reissues, reexaminations, continuations, continuations-in-part, divisionals and foreign counter-parts thereof, but in each case only to the extent first filed on or after the Effective Date, where ***"Priority"*** means a formal claim of priority to the filing date of an earlier patent or patent application that is expressly made (i) in a U.S. patent under 35 U.S.C. § 119, 35 U.S.C. § 120, 35 U.S.C. § 121, or 35 U.S.C. § 365; or (ii) in a foreign patent under the corresponding legal requirements for claiming priority in the foreign country, including under the Paris Convention or PCT (collectively the "***Assigned Patents***");

NOW, THEREFORE, in consideration of entering into the Patent Transfer Agreement and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor agrees as follows:

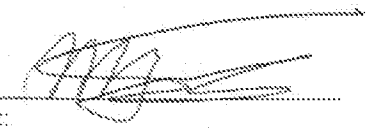
Assignor does hereby assign and transfer and convey unto Assignee its entire right, title and interest in and to the Assigned Patents listed in Appendix I hereto, including Assignor's rights under the Assigned Patents to sue for injunctive relief and damages for past, present and future infringement of the Assigned Patents.

Assignor hereby authorizes the respective patent office or governmental agency to record the Assigned Patents and any reissues or reexaminations thereof in the name of Assignee, as the assignee of the entire interest therein.

This Assignment shall be construed and interpreted in accordance with the Patent Transfer Agreement. Nothing in this Assignment shall, or shall be deemed to, modify or otherwise affect any provisions of the Patent Transfer Agreement or affect or modify or expand any of the rights or obligations of the parties under the Patent Transfer Agreement. In the event of any conflict between the provisions hereof and the provisions of the Patent Transfer Agreement, the provisions of the Patent Transfer Agreement shall govern and control. Neither Assignor nor Assignee makes any representations or warranties of any kind, whether express, implied, or otherwise, under this Assignment, all of which are governed solely by the Patent Transfer Agreement.

IN WITNESS WHEREOF, Assignor has caused this Assignment to be executed by its respective duly authorized representative as of the Effective Date.

Applied Transform, LLC



By: _____
Name:
Title:

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of Sonoma)

On 8/26/2021 before me, Uriel Rene Medina Del Toro, Notary Public
(insert name and title of the officer)

personally appeared Marcus C. Tzannes

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature _____ (Seal)

URIEL RENE MEDINA DEL TORO
COMM. #2340626
NOTARY PUBLIC - CALIFORNIA
SONOMA COUNTY
My Commission Expires 12/20/2024

EXHIBIT A

LISTED PATENTS

Applied Transform, LLC - 8365-87 Family

Reference #	Title	Country ID	Status	Serial #	Filed Date	Publication #	Patent #	Issue Date
8365-87-PCN	Header Repetition Scheme in Packet-Based OFDM Systems	CN	ISSUED	201080037081.2	8/20/2010	CN102484567	ZL201080037081.2	2/10/2016
8365-87-PCN-DIV	OFDM Communication Method and OFDM Communication Transmitter	CN	ABANDONED	201610031574.3	8/20/2010	CN 105681000 A		
8365-87-PCT	Header Repetition Scheme in Packet-Based OFDM Systems	WO	NAT PHASE	PCT/US2010/046088	8/20/2010	WO 2011/022593		
8365-87-PEP	Header Repetition Scheme in Packet-Based OFDM Systems	EP	ABANDONED	10748023.8	8/20/2010	2467962		
8365-87-PROV	Header Repetition Scheme in Packet-Based OFDM Systems	US	EXPIRED	61/235,909	8/21/2009	N/A		
8365-87-PUS	METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS	US	ISSUED	13/376,856	2/8/2012	US 2012-0170625 A1	9,564,262	2/28/2017
8365-87-PUS-CON	METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH MULTIPLE OVERLAPPED FREQUENCY BANDS	US	ISSUED	15/350,418	11/14/2016	US 2017-0063415 A1	9,614,566	4/4/2017
8365-87-PUS-CON-2	TRANSMITTER METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK	US	ISSUED	15/476,284	3/31/2017	US 2017-0207940 A1	9,973,361	5/15/2018
8365-87-PUS-CON-3	RECEIVER METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK	US	ISSUED	15/958,519	4/20/2018	US 2018-0248725 A1	10,079,707	9/18/2018
8365-87-PUS-CON-4	TRANSMITTER METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH DIFFERENT CHANNEL BANDWIDTHS	US	ISSUED	16/125,206	9/7/2018	US 2019-0007247 A1	10,291,449	5/14/2019

8365-87-PUS-CON-5	RECEIVER METHOD AND APPARATUS FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK WITH DIFFERENT CHANNEL BANDWIDTHS	US	ISSUED	16/394,490	4/25/2019	US 2019-0253290 A1	10,554,459	2/4/2020
8365-87-PUS-CON-6	Non-transitory computer-readable information storage media for variable header repetition in a wireless OFDM network	US	ISSUED	16/780,589	2/3/2020	US 2020-0169438 A1	10,917,272	2/9/2021
8365-87-PUS-CON-7	HEADER REPETITION IN PACKET-BASED OFDM SYSTEMS	US	PUBLISHED	17/136,801	12/29/2020	US 2021-0119841 A1		